

88046027

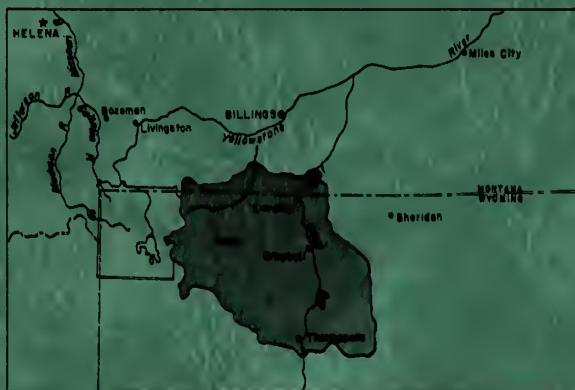
PRELIMINARY

PLANNING AND CLASSIFICATION REPORT
AS RELATES TO THE PUBLIC DOMAIN LANDS

IN THE

BIG HORN BASIN

AND

CLARK FORK OF THE YELLOWSTONE

PROPERTY OF
Bureau of Land Management
D S C LIBRARY

WYOMING-MONTANA

A MISSOURI RIVER BASIN INVESTIGATION**(FOR ADMINISTRATIVE USE ONLY)**

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
REGION III
BILLINGS, MONTANA

NOVEMBER 1950

HD
243
.W8
P745
1950b

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

HD
243
.W8
P745
19506

Preliminary
Land Planning and Classification Report
as relates to the public domain lands
in the

BIG HORN BASIN

and

Clark Fork of the Yellowstone
(Wyoming and Montana)

PROPERTY OF
Bureau of Land Management
D S C LIBRARY

A Missouri River Basin Investigation

(For Administrative Use Only)

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
REGION III
BILLINGS, MONTANA

November, 1950

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

This study is a feature of the program of the
Department of the Interior for the development of the
resources of the Missouri River Basin.

CONTENTS

Page No.

INDEX OF TABLES	
INDEX OF MAPS	
ACKNOWLEDGMENTS	I
PURPOSE AND SCOPE	II
SUMMARY	III
GENERAL DESCRIPTION	1
Location and Size	1
Physiography	2
Climate	2
Drainage and Water Supply	10
VEGETATION	13
SOILS	16
ECONOMIC AND CULTURAL DEVELOPMENT	18
Agriculture	21
Mineral Deposits	27
Recreation and Wildlife	29
Lumbering	30
LAND OWNERSHIP	31
LAND MANAGEMENT PROGRAMS	37
Bureau of Land Management	37
Bureau of Reclamation	42
Bureau of Indian Affairs	51
U. S. Forest Service (Department of Agriculture)	51
National Park Service	51
State Lands (Wyoming)	51
State Lands (Montana)	52
Railroad Lands (Northern Pacific)	52
Soil Conservation Districts	52
Production and Marketing Administration	52
PROBLEMS AS RELATE TO PUBLIC LAND ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT	55
Problem 1 - Watershed Breakdown and Consequent Siltation of Stream Courses and Reservoirs	55
Problem 2 - Land-use Adjustments	62
Problem 3 - Multiple and Conflicting Uses of the Public Land	64
Problem 4 - Land Tenure	64
Problem 5 - Other or Related Problems	67
CONCLUSIONS AND RECOMMENDATIONS	69
MAP APPENDIX	Map Jacket

INDEX OF TABLES

	<u>Page No.</u>
Table 1 - Average monthly and annual precipitation at stations in the Big Horn Basin, Wyoming and Montana, 1947	7
Table 2 - Temperature records of stations in the Big Horn Basin, Montana and Wyoming, 1947	9
Table 3 - Classification of land ownership and acreage by counties within the Big Horn Basin report area, Wyoming and Montana, 1950	33
Table 4 - Lands administered by the Bureau of Land Management by areas of responsibility, within and outside grazing districts in the Big Horn Basin, Wyoming and Montana, 1950	34
Table 5 - Classification and distribution of Federal land ownership by major watersheds in the Big Horn Basin, Wyoming and Montana, 1950	35
Table 6 - Irrigated and irrigable areas of Shoshone reclamation project divisions, 1950	43
Table 7 - Summary of principal reclamation developments proposed by Bureau of Reclamation in the Big Horn Basin, 1950	45
Table 8 - Proposed irrigation storage reservoirs in the Big Horn River Basin, Wyoming, 1950	46
Table 9 - Lands withdrawn for reclamation purposes within Big Horn Basin, 1950	50
Table 10- Runoff and suspended sediment discharge, Big Horn River, Wyoming and Montana	71
Table 11- Acre feet of suspended sediment per acre-foot of runoff and per square mile of watershed area, Big Horn River, Wyoming and Montana	72

INDEX OF MAPS

Number	Title	Page No.
Principal Map	Big Horn River Basin Public Domain Map, Montana and Wyoming	Map Appendix
Map No. 2	General Location Map of Big Horn Basin	(opposite) 1
Map No. 3	Topography Within Big Horn Basin	3
Map No. 4	Average Annual Precipitation Within Big Horn Basin	6
Map No. 5	Mean Annual Water Yield Within Big Horn Basin	11
Map No. 6	Vegetative Cover Within Big Horn Basin	14
Map No. 7	Land Use Within Big Horn Basin	22
Map No. 8	Major Land Management Activities Within Big Horn Basin	36
Map No. 8A	Proposed Study Areas and their Relationship to Major Land Management Activities Within Big Horn Basin	74

ACKNOWLEDGMENTS

Information contained in this preliminary report was gathered from many sources including published reports and documents of numerous Federal, state and local governmental agencies. Among these agencies are the Bureau of Reclamation, Bureau of Indian Affairs, Bureau of Mines, U. S. Geological Survey, National Park Service, Fish and Wildlife Service and the Bureau of Land Management, all within the Department of the Interior; U. S. Forest Service, Soil Conservation Service, Production and Marketing Administration and the Extension Service within the Department of Agriculture; Bureau of Census, U. S. Weather Bureau within the Department of Commerce, States of Montana and Wyoming and local governmental agencies.

Preliminary field surveys and assembly of pertinent information were performed by L. R. Brooks, Range Manager, and Paul H. Crouter, Range Conservationist, and Harold T. Tysk, Land Economist, in cooperation with personnel of the Tensleep Grazing District, stationed at Worland, Wyoming. Analysis of pertinent data and preparation of the report was accomplished by Harold T. Tysk and R. D. Nielson, Land Economists. The maps and illustrations which form a part of this report were prepared in the Billings drafting office under the supervision of William C. Anderson, Engineering Draftsman.

The work was carried on as a function of the Division of Land Planning, Region III, Bureau of Land Management, and the study in all its aspects was under the general supervision of R. D. Nielson, Chief, Division of Land Planning, Region III, Bureau of Land Management, Billings, Montana.

PURPOSE AND SCOPE

This report presents a preliminary analysis of the physical and economic features of the Big Horn Basin, Montana and Wyoming. The report includes a general description of the basin's resources, its needs and problems and its present and potential development. It is intended to serve as a guide for carrying out detailed studies of problems pertaining to the use, management and development of the three and one-half million acres of public domain in the basin and their interrelationship to the numerous and varied land management programs of other Federal, state and local governmental agencies and interests in furtherance of the over-all Missouri River Basin Development Program.

In carrying on the preliminary investigation and in presenting the information in this report, primary concern has been to develop factual data relating to the uses and resources of the unappropriated public domain and in this connection a general analysis of all land management programs operating in this area has been made. Based primarily upon the location, amount and extent of public lands in the area, the basin has been delineated into nine areas for the detailed studies which will follow.

While this preliminary report is complete in itself, insofar as public domain within the Big Horn Basin is concerned, its value will be supplemented by the report for an adjoining area; the Wind River Basin, which forms the headwaters of the Big Horn River. This report, published in June, 1949, is entitled "Detailed Land Planning and Classification Report as Relates to the Public Domain Lands in the Wind River Basin, (Wyoming), Bureau of Land Management, Region III, Billings, Montana." This report presents a detailed analysis of the public domain, its present development, utilization and condition, its problems and needs and the interrelationship of the resources of the public domain with other resources and the over-all economy of the Missouri River Basin. A similar detailed report will be prepared for the public land areas described in this preliminary report.

This report may also serve to set the stage for carrying out detailed investigations and programs for rehabilitating depleted and deteriorated areas through application of soil and moisture conservation practices and measures.

SUMMARY

The region described in this report encompasses that portion of the watershed of the Big Horn River between Boysen Dam located in Wind River Canyon to the south and the Yellowtail Dam Site located in Big Horn Canyon in south-central Montana to the north, embracing an area of 13,500 square miles. Also included is the area drained by the upper reaches of the Clark Fork of the Yellowstone River in Wyoming and Montana (drainage area above Fromberg, Montana), which constitutes an area of 1,900 square miles. Eighty-eight per cent of the report area is located in Wyoming and the remaining 12 per cent in Montana.

The basin resembles an irregularly-shaped bowl, the outer fringe consisting of rugged, jutting portions of the Rocky Mountains. The eastern portion is formed by the Big Horn Range. The south boundary is formed by the Copper Mountain and Owl Creek Mountain, which forms a topographic segment of the major Big Horn-Wind River Basin. High mountain masses of the Absaroka Range forms the western boundary, while the north boundary in Montana is formed by the Pryor Mountains and upper portions of the Clark Fork of the Yellowstone River.

Climatologically, the basin has extremes varying from year-around snow cover and heavy precipitation in the mountains to semi-desert conditions in the basin proper. Summers are relatively short and winters long. Winters are rigorous but are usually less extreme than in the Great Plains east of the mountains.

Vegetation varies from desert salt-brush at lower elevations to alpine associations, including conifer timber and mountain meadows in the high mountains. Public lands under the supervision of the Bureau of Land Management are located for the most part on the valley floor and foothill portion of the basin and as a group have a relatively sparse vegetative cover. These semi-arid lands, however, have an important place in the year-long livestock operational setup for basin operators, since they provide a large part of the range livestock feed for winter, spring and fall, as well as some for the summer.

Agriculture and petroleum production are the principal industries of the basin. Production of oil in the basin in 1949 totalled nearly 27,000,000 barrels and nearly 2,500,000 barrels in Montana. Elk Basin, located within the report area, is Wyoming's biggest oil producing field. Gas production is also important. Agricultural products include cattle and sheep from the vast range areas. Major irrigated farm enterprises associated with range livestock ranching include production of alfalfa hay, sugar beets and beans. About three per cent of the land in the basin is cultivated, while most of the remainder is used for grazing purposes. Land under cultivation is all irrigated. Crops from approximately 288,000 acres were harvested in 1948, hay crops making up 43 per cent of the total, grains 23 per cent, dried beans 21 per cent, crop lands used for pasture 8 per cent, sugar beets

4 per cent and miscellaneous crops 1 per cent. Livestock feeding and fattening is becoming an increasingly important enterprise in the basin, with most of the feeding business being centered around the sugar beet industry, mainly in the vicinity of Worland, Lovell and Powell, Wyoming.

The basin is important from a recreational standpoint. It adjoins Yellowstone National Park; and Cody, Wyoming is second only to the west entrance as the route of the heaviest travel into this park. The mountains abound in big game, fishing streams and lakes, timber, scenic campsites and even wilderness areas which may be reached only by pack trips. Deer, elk, bear, moose and mountain sheep inhabit the higher mountain areas; while antelope and deer are found in the lower plateau or basin areas. Lumbering, while a comparatively minor industry in the basin, is important locally.

Seventy-one per cent of the entire area (8,745,820 acres) is in Federal ownership or under Federal management. The Department of Interior has jurisdiction over 4,150,688 acres of this land, while the remaining 2,026,804 acres consists of National Forests administered by the Forest Service, Department of Agriculture. The three principal agencies of the Department of the Interior which administer lands in the basin are the Bureau of Land Management (3,501,649 acres), the Bureau of Indian Affairs (476,060 acres), and the Bureau of Reclamation (346,521 acres 1/).

About 90 per cent of Interior Department lands are situated within three grazing districts and include not only vacant, unappropriated public domain but also various types of lands withdrawn for special purposes; reclamation withdrawals and stock-driveway withdrawals being the most important.

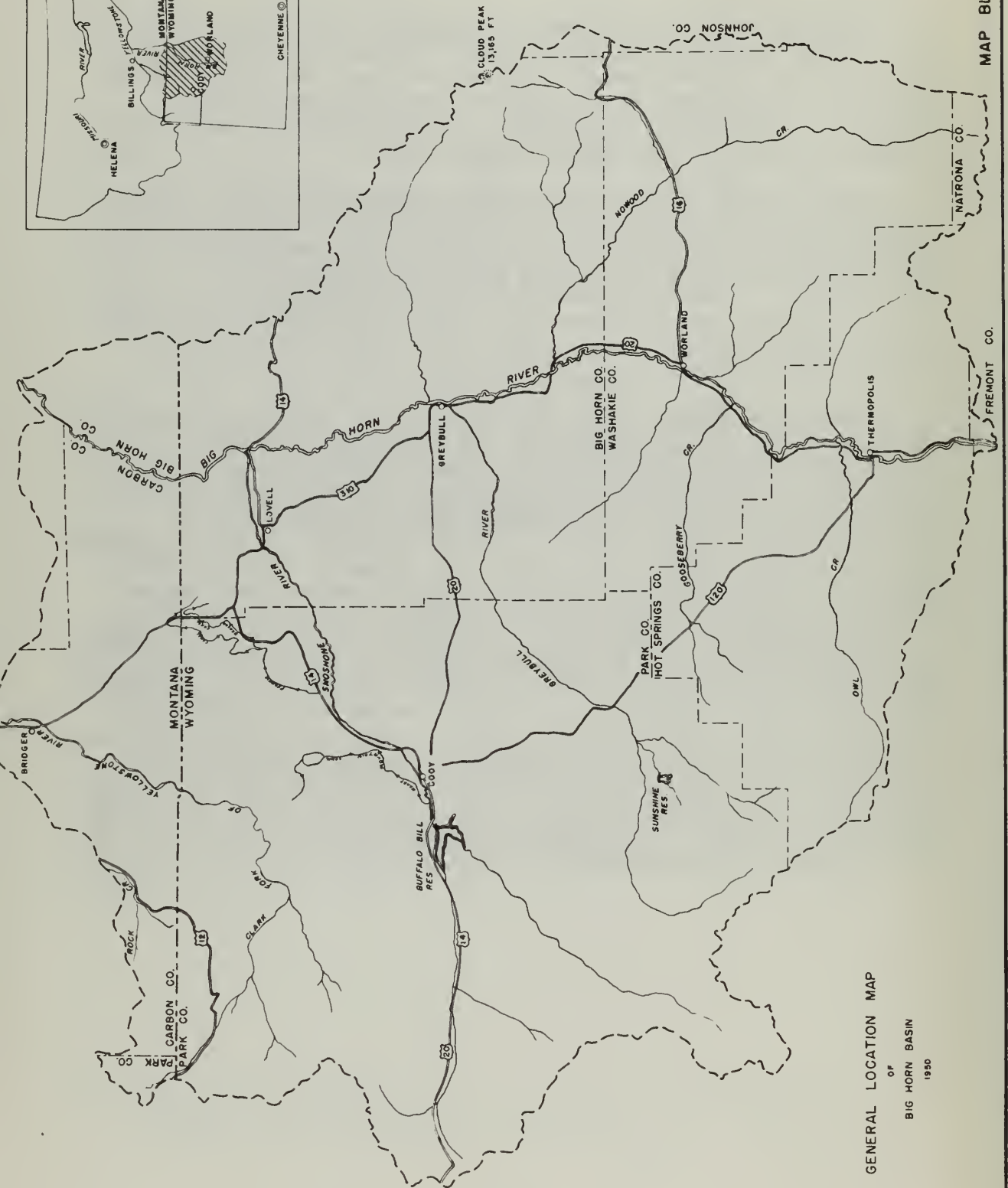
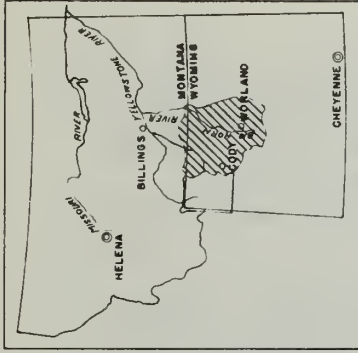
Three National Forests, Custer in Montana and Big Horn and Shoshone in Wyoming, embrace a net area of 2,026,804 acres or 23 per cent of the report area. Five per cent of the gross area within the Big Horn Basin is comprised by lands administered and owned by the States of Montana and Wyoming. Lands in private ownership, including railroad grant lands, embrace 24 per cent of the entire basin and comprise 2,133,321 acres.

1/ 185,254 acres administered by the Bureau of Land Management by agreement with the Bureau of Reclamation.

Existing and proposed development and management programs in the area are numerous and varied, chief of which are the programs of the Bureau of Land Management, administered under the provisions of the Taylor Grazing Act, Forest Service, Bureau of Reclamation, Bureau of Indian Affairs and States. One state park and one National monument have been established for small areas.

The principal problems that relate to the public domain within the basin are: (1) the need for proper watershed management and erosion control; (2) integration of grazing land uses with crop land uses for the most satisfactory and sound land-use economy; (3) conflicts in the multiple-use of the public domain; (4) complexity in land ownership and management and tenure, especially as pertains to lands under various forms of withdrawal; (5) need for cadastral surveys and re-surveys.

Detailed examination and classification of the public domain is necessary to obtain an inventory of the extent and character of the public land and resources, including timber, forage and soil. A determination of the physical capabilities and use limitations of the public land and how and to what extent they contribute to such problems as erosion and siltation, floods, pollution, fires and noxious weed and predatory damage is essential to determine how the public lands and their resources can best be used and managed for highest sustained productivity, and can best contribute to the needs of wildlife, recreation and similar public programs. It should provide basic data for carrying out sound land-use management programs for areas that have multiple uses of public interest. It should set the stage and provide basic information necessary to carry out comprehensive land and resource rehabilitation, protection and development programs. It should provide the basic information for working out land-use adjustments and coordination of various land uses in order that these public lands may contribute most to the general welfare of the people of the basin and the Nation under the comprehensive resource development program for the Missouri River Basin.



GENERAL DESCRIPTION

Location and Size

The Big Horn River, largest tributary of the Yellowstone River, drains an area of approximately 23,000 square miles, of which 17 per cent is in south-central Montana and 83 per cent is in north-central Wyoming. This constitutes about one-third of the drainage area of the Yellowstone River Basin. Headwaters are formed by the joining of the Wind and Popo Agie Rivers, whose sources are high on the crest of the mountainous and heavily-forested Continental Divide in Fremont County, Wyoming. Its basin is divided into three distinct topographic segments, known in downstream order as the Wind River Basin in Wyoming ^{1/}, the Big Horn Basin in Wyoming and Montana and the Lower Big Horn Basin in Montana. Deep canyons and mountain masses separate these three basins. It is with respect to the central basin—the Big Horn Basin in Wyoming and Montana—that this report is primarily concerned.

The Big Horn Basin, as hereinafter described in this report, encompasses that portion of the watershed of the Big Horn River between Boysen Dam, located in Wind River Canyon to the south and the Yellowtail Dam site, located in the Big Horn Canyon in south-central Montana, embracing an area of 13,500 square miles. Also included as a part of the report, is the area drained by the upper reaches of the Clark Fork of the Yellowstone River in Wyoming and Montana, which is similar in its physical, cultural and economic characteristics and constitutes an area of 1,900 square miles. Existing and potential uses and developments of public lands in this part of the report area are closely related to the comprehensive development programs being carried on in the Big Horn Basin.

Eighty-eight per cent of the report area is located in Wyoming and the remaining twelve per cent in Montana.

^{1/} A report published by the Bureau of Land Management in June 1949, entitled, "Detailed Land Planning and Classification Report as Relates to the Public Domain Lands in the Wind River Basin, Wyoming", presents a detailed inventory of the resources and an analysis of the problems of that basin, relative to the public domain lands. An introductory report published in June 1947, presented a preliminary analysis of the physical and economic features of the Wind River Basin as they relate to the Boysen Dam, now under construction in Wind River Canyon.

Physiography

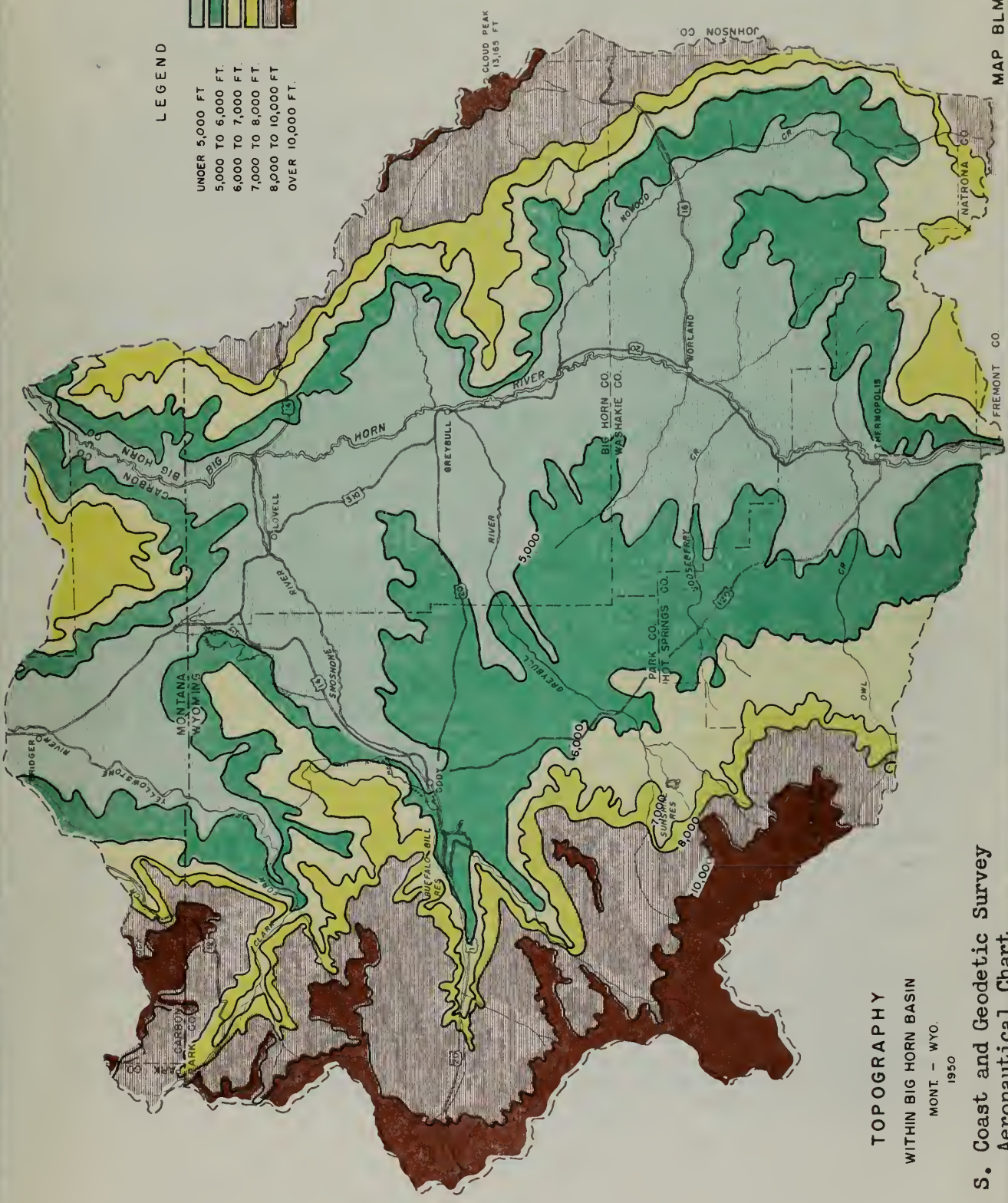
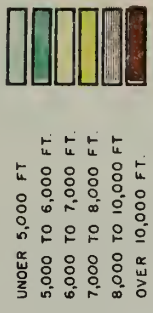
The basin resembles an irregularly-shaped bowl, the outer fringe consisting of rugged, jutting portions of the Rocky Mountains. The basin floor is made up of a series of benches and terraces ranging in elevation from about 4,000 to 5,000 feet above sea level dissected by a number of water courses with narrow valleys. The four major streams are the Big Horn, Shoshone, Greybull and Clark Fork of the Yellowstone Rivers. Owl, Cottonwood, Fifteen Mile, Gooseberry, Crooked, Sage and Dry Creeks enter the Big Horn River from the west, and Kirby, Beaver, No Water, Nowood and Shell Creeks drain from the east.

The mountains and foothills along the exterior portions of the basin are generally rugged with many high peaks and deep canyons that were formed as the streams emerged from the mountains to the lower foothills. The highest point is Cloud Peak with an elevation of 13,165 feet, located in the Big Horn Mountains which rise abruptly from the Great Plains. The principal canyons are the Wind River and the Big Horn Canyons along the main stream at the upper and lower extremities of the basin, respectively. Wind River Canyon has a maximum depth of approximately 2,250 feet. Big Horn Canyon, the site of Yellowtail Reservoir, is third in size of our nation's deep canyons, exceeded only by Snake River in Idaho and the Grand Canyon of the Colorado River in Arizona. Other canyons, only slightly less significant, include Shoshone Canyon, west of Cody; Tensleep Canyon, east of Tensleep and Shell Creek Canyon, east of Shell. U. S. Highway 20 follows Shoshone Canyon to Yellowstone National Park. Buffalo Bill Dam is located in this canyon. Highway 14 enters Shell Canyon and winds above to cross the Big Horn Mountains. Highway 16 follows Tensleep Canyon to the summit of the Big Horns. The lower elevation bench and terrace lands of the interior of the basin are level to gently sloping, except where broken by badlands which terminate in irregular ridges and sharp peaks or by projecting buttes and short ranges of hills scattered over the area. Examples of these hills are to be found in McCullough Peaks, south of the Shoshone River near Cody; the Big and Little Sheep Mountains, near the mouth of the Shoshone River and Tatman Mountain, south of the Greybull River in western Big Horn County, Wyoming.

Climate

Climatic conditions largely determine the type of farming and exert an important influence on the financial returns from agriculture. The sparsity of rainfall and relatively short growing season in the Big Horn Basin restricts the agricultural utilization of land to grazing or to the production of irrigated crops of the hardy and early maturing varieties of hay, grain, beets and beans. The mountain areas are useful for grazing, timber, recreation, wildlife and as a watershed. The climate varies widely with elevational changes and is generally considered arid, except in the higher mountains where it is semi-arid to humid.

LEGEND



TOPOGRAPHY
 WITHIN BIG HORN BASIN
 MONT - WYO.
 1950

From: U. S. Coast and Geodetic Survey
 Aeronautical Chart

The basin proper is characterized by low amounts of precipitation of variable distribution and occurrence, comparatively long, cold winters and short, hot summers. It likewise has a large amount of sunshine, low humidity, a high evaporation rate and a relatively small amount of wind as compared with the Great Plains portions of Wyoming and Montana.

Several U. S. Weather Bureau Stations are located in the agricultural sections of the basin. The mean annual precipitation of the non-mountainous portions of the basin ranges from approximately five inches at Hyattville, Deaver and Powell to 12 inches at Buffalo Bill Dam and Thermopolis. In the intermediate zone where Lovell, Worland and Cody are located, the annual precipitation approximates eight inches.

Precipitation increases with the elevation and approaches 30 inches annually in the mountainous sections around the fringe of the basin as indicated by the highest average record station in Yellowstone National Park and by the Dome Lake station in the Big Horn Range.

During the 30 years of record at Worland for the period 1914 to 1943, inclusive, 15 years show below average precipitation, 13 years show above average and the rainfall record was incomplete for two years. The average annual precipitation for the period of record through 1943 was 7.89 inches. The two years of lowest rainfall were 1919 with 3.03 inches, followed by 1920, with only 4.50 inches. The two years having the highest rainfall were 1923 with 12.15 inches and 1928 with 11.93 inches. Since Worland rainfall records are considered fairly typical for the low lying lands of the basin it can be seen that during even the best precipitation years the moisture is inadequate to support farm crops. Where the rainfall is normally as low as in this area, minor fluctuations, either in lower amount or in less favorable distribution, are sufficient to disturb the balance in forage supply for livestock operations. This can be a contributing factor to overgrazing of range lands because shortage of feed on the range compels operators to reduce the size of their herd or overgraze the native range resource, or secure supplementary feed elsewhere. Normally the average livestock operator is not in a favorable position for either decreasing the size of his herd or for obtaining feed from other sources. Irrigated land may be utilized as a buffer to produce supplementary feeds for range livestock as a protection to the industry and the range.

The manner in which precipitation is distributed throughout the year has an important influence on the production of natural vegetation and on the water supplies available for irrigation purposes. In the lower or arable portion of the Big Horn Basin, May and June are the months of heaviest precipitation. Forty per cent or more of the annual precipitation falls during the three months' period, April through June,

and 65 to more than 70 per cent during the growing season, April through September. This distribution is ideal for range forage production and would be ideal for dry farming if the amount of precipitation were adequate.

In mountainous areas, moisture falls principally as snow, much of it in late spring and early summer, March through June. Other than in the mountains the snowfall is relatively light, seldom exceeding more than a few inches in any one storm. Occasionally, however, snow falls on winter ranges to depths sufficient to hamper winter grazing by sheep or cattle. The average annual snowfall ranges from about 12 inches at Powell to more than 100 inches on mountain summits. At times frozen or crusted snow interferes with winter grazing thus necessitating the removal of livestock to ranches for feeding. Late spring snows, which sometimes occur as blizzards, result in severe losses to stockmen, especially sheep operators. Summer rains are usually only local and cover relatively small areas. They often occur as heavy downpours lasting for only brief periods. Such rains generally cause serious soil erosion and siltation damage, but where not too heavy also do much good in sustaining plant growth and in filling stock water reservoirs.

Normally the rain and snow come from the west. The direction of moisture-laden winds in this area is from the west, southwest or northwest and the source of moisture supply is largely from the Pacific Ocean. However, continental storms from the Gulf of Mexico often occur during the spring and summer. The extreme distance from oceanic moisture source together with the sheltering effect of the surrounding mountain barriers, especially on the west, result in less precipitation than normally would be expected. Moisture-laden air must rise roughly 7,000 feet over mountains from source before precipitation is dropped in the Big Horn Basin 1/.

Table No. 1 shows the average monthly and annual precipitation for 13 weather bureau stations located in the Big Horn Basin.

In the valleys and foothills during the summer the days are hot and the nights are cool. Winters are rigorous, but are usually less extreme than in the Great Plains east of the mountains. Summers are relatively short and winters long. The spring season is cool and the fall is normally mild and pleasant.

1/ "An estimate of maximum possible flood-producing meteorological conditions in the Big Horn Basin above Boysen Dam site," prepared by the Cooperative Studies Section, Office of Hydrologic Director, January 5, 1946, (U. S. Department of Commerce - Weather Bureau).



AVERAGE ANNUAL PRECIPITATION

(in inches)

WITHIN BIG HORN BASIN

MONT. - WYO.
1950

From U. S. D. A. Yearbook, 1941

Table 1 - Average monthly and annual precipitation at stations in the Big Horn Basin, Wyoming and Montana, 1947 ^{1/}

Station	Elevation (feet)	January (inches)	February (inches)	March (inches)	April (inches)	May (inches)	June (inches)	July (inches)	August (inches)	September (inches)	October (inches)	November (inches)	December (inches)	Total Annual (in.)	6 Mo. (Apr.- Sept.) (in.)	Length of Record (years)
Montana																
Bridger ^{2/}	3,680	.26	.30	.59	1.01	1.80	1.62	.88	.66	1.31	1.16	.47	.36	10.42	7.28	38
Red Lodge (near) ^{2/}	5,548	.70	.71	1.31	2.37	3.26	2.32	1.45	1.23	1.84	1.72	.83	.64	18.38	12.47	47
Wyoming																
Basin	3,837	.41	.34	.53	.78	1.07	.94	.49	.38	.65	.57	.34	.34	6.84	4.31	45
Buffalo Bill Dam	5,156	.43	.40	.69	1.14	1.90	1.59	1.20	.95	1.08	.77	.47	.43	11.05	7.86	43
Cody	4,984	.27	.31	.50	1.05	1.39	1.56	1.05	.80	.95	.78	.46	.30	9.42	6.80	40
Deaver	4,105	.19	.15	.22	.50	.99	1.04	.56	.45	.64	.38	.21	.22	5.55	4.18	32
Dome Lake	7,847	1.53	1.33	2.76	3.91	3.35	2.66	2.07	1.55	1.96	2.43	1.98	1.62	27.15	15.50	28
Hyattville	4,447	.36	.20	.46	.58	.50	.64	.16	.36	.37	.46	.27	.35	4.71	2.61	25
Lovell	3,825	.42	.27	.35	.62	1.21	1.09	.61	.49	.71	.56	.31	.28	6.92	4.73	40
Powell	4,389	.17	.11	.20	.49	1.04	1.21	.63	.49	.80	.39	.23	.15	5.91	4.66	41
Snake River	6,882	4.10	2.90	3.29	2.19	2.37	2.45	1.48	1.59	1.69	2.01	2.69	3.01	29.76	11.77	34
Thermopolis	4,350	.39	.40	.92	2.11	2.42	1.36	1.00	.73	1.24	1.15	.56	.44	12.72	8.86	42
Worland	4,061	.35	.26	.41	1.01	1.34	1.29	.81	.56	.85	.70	.37	.25	8.20	5.86	38

^{1/} Climatological Data, Weather Bureau, Department of Commerce, Wyoming and Montana Sections, Year 1947, and

^{2/} Climate and Man, Yearbook of the Department of Agriculture, 1941.

Table No. 2 shows the January and July average temperatures and maximum and minimum temperatures for the various weather bureau stations in the basin during the period of record for each station. It also shows the average dates of the last killing frost in the spring and of the first killing frost in the fall. The length of growing season varies with elevation, and for the non-mountainous portion of Big Horn Basin the frost-free period ranges from approximately 121 days at Thermopolis and Hyattville to 140 days at Worland, and 142 days at Buffalo Bill Dam. The date of the latest killing frost in the spring ranges from May 10 at Worland and Buffalo Bill Dam to May 19 at Thermopolis and May 23 at Hyattville, while the date of the first killing frost in the fall ranges from September 17, 18, 19 at Thermopolis, Lovell and Cody, respectively, to September 27 at Worland and September 29 at Buffalo Bill Dam. In occasional years exceptionally late frosts in the spring or especially early fall frosts do considerable damage. In average years, however, the growing season throughout the crop-producing portion of the basin is sufficiently long to mature nearly all of the hardy agricultural crops commonly grown in this intermountain area.

The relative atmospheric humidity in the basin is low, averaging from 45 to 55 per cent annually and approximately 30 per cent during the growing season, dropping to considerably less in localized areas for short periods. Since the rainfall in Big Horn Basin is less than that in other parts of the state the relative humidity of the basin is lower than the average for the state. This dry atmospheric condition is conducive to high evaporation, especially when associated with high summer temperatures and with relatively high wind velocities. Wind velocity is extremely variable, but in the Big Horn Basin it is somewhat less than for the state as a whole which averages about 10 miles per hour. Since the effectiveness of soil moisture on crop production and vegetative growth is influenced by the amount of evaporation, the factors of temperature, humidity and wind velocity are especially important during the growing period. Although no evaporation records from a free water surface are available for Big Horn Basin stations, a seasonal (April through September) evaporation record for a 19 year period for Sheridan, just across the Big Horn Mountains eastward from the basin, shows an average of 34.86 inches to have been evaporated seasonally. Wind direction in the basin is usually west, southwest, or northwest and when velocities of 20 miles per hour or more are sustained for several minutes at a time they cause soil erosion as well as a high rate of evaporation. Sustained periods of hot, drying winds are not uncommon in spring, summer, and fall while in winter the area experiences both cold "northers" and warmer "chinook" winds.

Table 2.- Temperature records of stations in Big Horn Basin, Montana and Wyoming, 1947 1/

Station	Elevation (feet)	Length of Record (years)	Temperature (degrees Fahrenheit)			Length of Record (years)	Average length of Growing Season (days)	Average Date of Killing Frost	
			Jan. Ave.	July Ave.	Max. Min.			last in Spring (date)	First in Fall (date)
<u>Montana</u>									
Bridger 2/	3,680	36	21.5	70.0	110	-35	123	May 18	Sept. 18
Red Lodge 2/	5,548	46	20.6	62.3	110	-40	100	June 4	Sept. 12
<u>Wyoming</u>									
Basin	3,837	42	15.5	74.3	114	-51	136	May 11	Sept. 24
Buffalo Bill Dam	5,156	41	26.8	69.5	100	-42	142	May 10	Sept. 29
Cody	4,984	41	23.7	69.3	105	-46	125	May 17	Sept. 19
Deaver	4,105	32	14.5	72.0	106	-42	131	May 16	Sept. 24
Dome Lake 2/	7,847	28	14.4	55.4	90	-42	55	July 2	Aug. 26
Hyattville	4,447	24	22.9	70.3	105	-34	121	May 25	Sept. 21
Lovell	3,825	39	16.0	71.1	111	-51	125	May 16	Sept. 18
Powell	4,389	39	18.2	70.2	103	-36	131	May 15	Sept. 23
Snake River 2/	6,882	28	12.9	58.2	93	-56	49	June 29	Aug. 17
Thermopolis	4,350	43	18.4	71.9	107	-44	121	May 19	Sept. 17
Worland	4,061	37	14.5	72.0	104	-51	140	May 10	Sept. 27

1/ Compiled from Climatological Data, U. S. Department of Commerce, Weather Bureau, Montana and Wyoming Sections, 1947.

2/ Compiled from records in "Climate and Man", yearbook of the Department of Agriculture, 1941.

Drainage and Water Supply

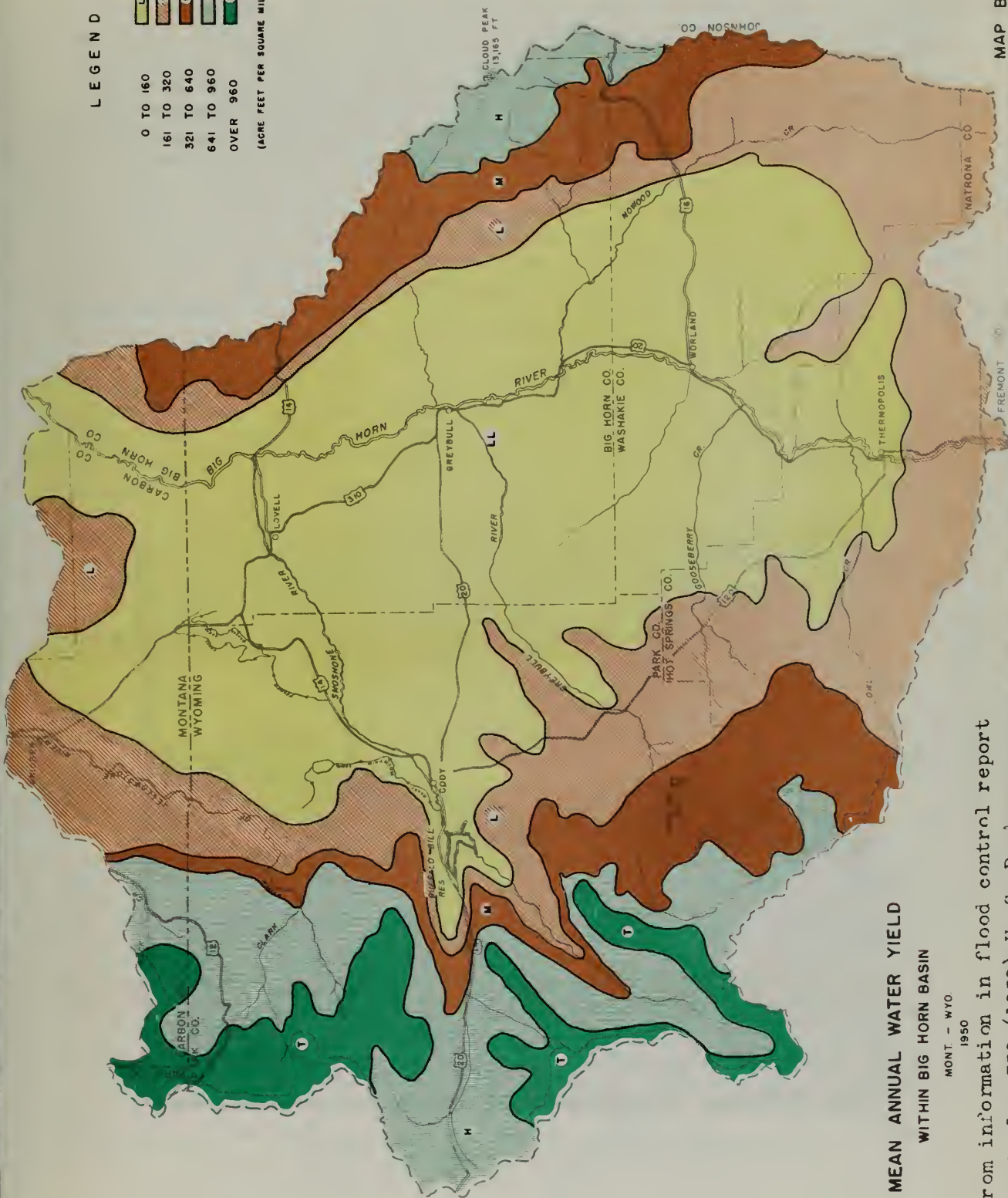
The Big Horn River drainage, between the proposed Boysen and Yellow-tail Dams, includes the normal flow of the river as it leaves the Wind River Canyon plus the accumulation of several tributaries. The two largest tributaries are the Shoshone and the Greybull Rivers, whose sources are in the Absaroka and Shoshone Mountain ranges which rise to elevations exceeding 12,000 feet. Other tributaries from the west, include Owl, Cottonwood and Gooseberry Creeks in the southwest part of the basin. The most conspicuous peaks in this area, as viewed from the foothills in the Upper Owl Creek drainage, are Washakie Needles, having a maximum elevation of 12,496 feet. Nowood, Paintrock and Shell Creeks, the principal Big Horn Basin tributaries entering Big Horn River from the east, have their source in the rugged Big Horn Mountains, the latter two in the vicinity of Cloud Peak.

The tributary streams enumerated above are typical mountain streams with water flowing through mountain meadows, parks and canyons in the upper headwaters. They leave the mountains and foothills through deep-cut gorges and canyons to emerge into the basin proper and, after crossing low-lying desert areas, join the Big Horn River. The elevation of Big Horn River at Boysen Dam is about 4,500 feet and on the Montana-Wyoming boundary line, where the river enters Big Horn Canyon, it is about 3,600 feet above sea level. The stream gradient of the river is fairly uniform, averaging approximately seven feet per mile, while the gradient of tributaries below the foothills ranges from 25 to 30 feet per mile. The main stream and its principal tributaries run in entrenched valleys with fertile flood plains which are sometimes a few miles in width. In some places steep escarpments and banks 50 feet to more than 100 feet high separate the flood plains from the higher bench lands of the basin floor.

According to reports by the Geological Survey about two-thirds of the annual runoff of the Big Horn River comes from the higher portions of the watershed. Comparatively little runoff occurs from the minor drainages that have headwaters at the lower elevations, although some runoff results from brief but heavy downpours of rain, especially during the spring and summer seasons. The mountain-fed streams are characterized by a period of high runoff during the months of May and June after which the flow declines rapidly until mid or late July, when a fairly steady flow is maintained.

Clark Fork of the Yellowstone River heads in the Absaroka Mountains in Park County, Montana, flows southeasterly through the Shoshone National Forest until it emerges from the Beartooth Mountains and then flows northerly through rolling land to the Yellowstone River in the vicinity of Laurel, Montana. Only the portion of this drainage area above Fromberg, Montana is encompassed in this report.

LEGEND



MEAN ANNUAL WATER YIELD

WITHIN BIG HORN BASIN

MONT. - WYO.

1950

Adapted from information in flood control report

Public Law 738 (1938) U. S. D. A.

Ground water is found generally outside the mountainous localities, but is not always available at depths that are within practical cost limits for development of domestic or livestock water. Wells drilled on favorable geologic sites generally afford adequate supplies at depths of from 100 to 300 feet. Springs or seeps are also an important source of domestic and stock water, especially in foothill areas adjacent to the mountains. Surface waters, resulting either from melting snows or from heavy rains, are often impounded for stock and domestic use and occasionally for irrigation by means of earth or earth and rock fill dams.



*Typical summer range south of Cody, Wyoming.
Erosion is slight and streams from watersheds with
this type of cover and soil carry little sediment*

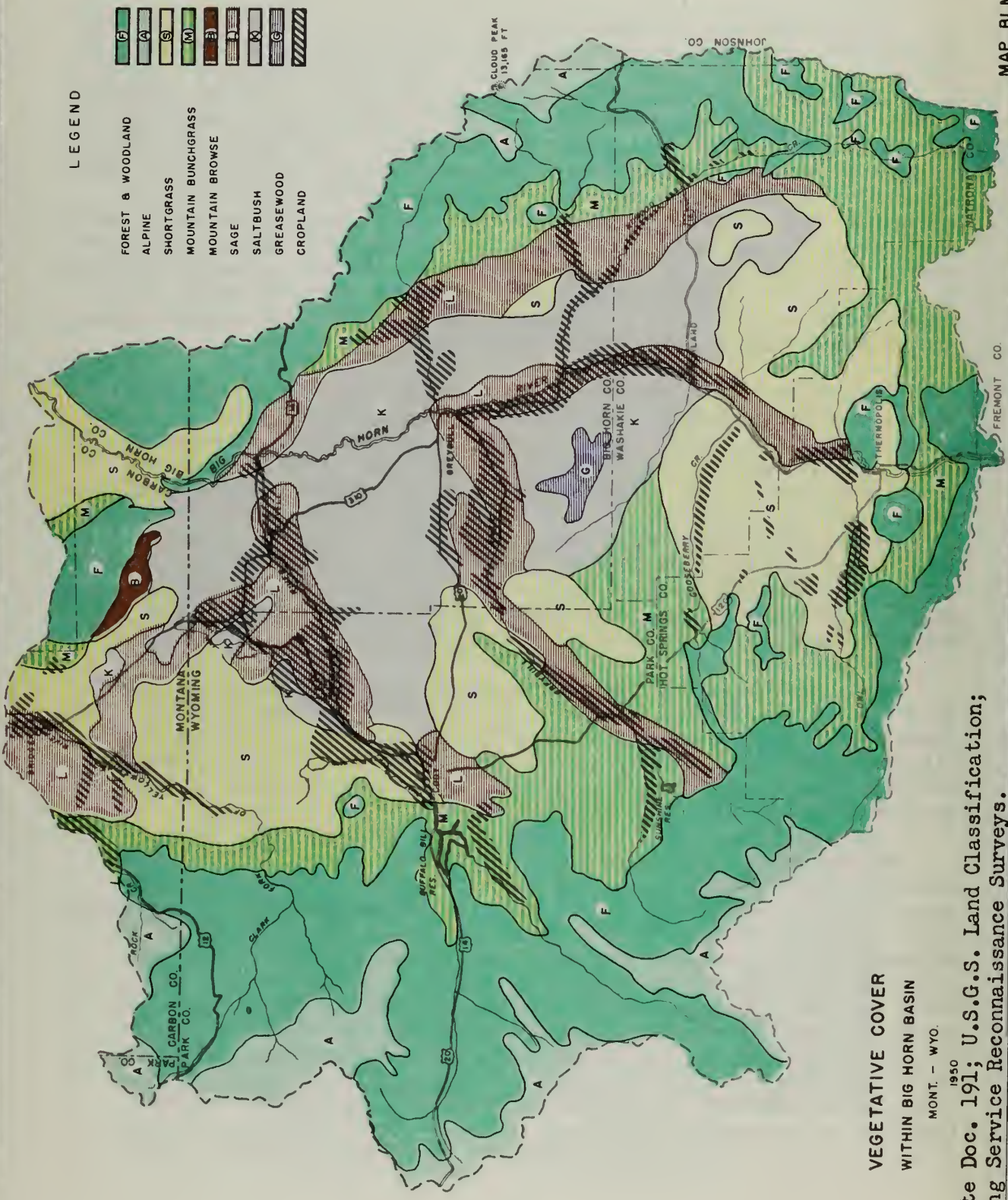
Vegetation

A wide variety of vegetation exists in the Big Horn Basin, as would be expected in an area so large and with such variations in elevation, topography, soil and climate. Vegetative types vary from desert saltbush at the lower elevations to alpine associations, including conifer timber and mountain meadows in the high mountains bordering the lower foothills and slopes. The better grazing lands lie at the higher elevations and near the foothills where moisture and soil conditions are most favorable. Public lands under the supervision of the Bureau of Land Management are located for the most part on the valley floor and foothill portions of the basin and as a group have a relatively sparse vegetative cover. These arid or desert type lands, however, have an important place in the year-long livestock operational setup for basin operators since they provide a large part of the range livestock feed for winter, spring and fall, as well as some of the summer feed.

The native vegetative cover of the valley floor is generally a sparse growth of shrubs, perennial grasses and annual grasses and weeds. Since these lands are the lowest, driest and often the most "alkali" impregnated, a good percentage of the total cover is of the saltbush association such as mat saltbush, shadscale and others of less significance. Associated species include greasewood on low-lying lands heavily impregnated with alkali salts and rabbit brush on fringes of bottom lands where the alkali content is relatively low. Other species intermingled in the saltbush type include bud sage, winter fat, squirreltail grass, Indian rice grass, grama and western wheatgrass, the latter being the most important of all grass components.

Small pockets or stringers of sagebrush are found in the better soil types along the valley floor. The saltbush type occurs in the lower flats in the so-called "badland" areas and lower foothills and alluvial fans. It is mainly a winter range type which can be used by both cattle and sheep, but is also used as spring-fall range in the absence of better range during these seasons.

Sagebrush and sage-grass types occupy high plains, foothills and high plateau areas and except for mountain meadows or straight grasslands, furnish some of the best grazing on the public lands of the basin. These lands generally receive a greater rainfall than do those of the saltbush types. Associates of sagebrush include western wheatgrass, bluebunch wheatgrass, grama grass, needlegrass, bluegrass and many other grasses. Other plants in this association include Indian paintbrush and many other weeds, shrubs, half-shrubs and annual grasses, including cheat grass, the latter occurring most abundantly on trails, sheep bed grounds and other areas of disturbed soils. Density, (per cent of ground cover) of vegetation of this type is usually greater than that of the saltbush type and under especially favorable circumstances may be as high as five-tenths to six-tenths, but the general



LEGEND

- | | |
|---------------------|-----|
| FOREST & WOODLAND | (F) |
| ALPINE | (A) |
| SHORTGRASS | (S) |
| MOUNTAIN BUNCHGRASS | (M) |
| MOUNTAIN BROWSE | (B) |
| SAGE | (D) |
| SALTBUUSH | (K) |
| GREASEWOOD | (G) |
| CROPLAND | (H) |

VEGETATIVE COVER
WITHIN BIG HORN BASIN

MONT. - WYO.
1950

From Senate Doc. 191; U.S.G.S. Land Classification;
Grazing Service Reconnaissance Surveys.

average is not more than three-tenths to four-tenths. Under present system of operations, lands in this class furnish grazing principally during spring, fall and summer, although small local areas are used as winter range.

Woodland types occur at the intermediate elevations and include juniper, mountain mahogany and sagebrush, in addition to a sparse undergrowth of shrubs, weeds and grasses. These types ordinarily occupy steep slopes and broken areas of the higher foothill country. Soils in woodland areas are usually rocky and shallow to the extent that a high density of vegetation generally cannot be supported. These lands are classed as spring-fall range, but not infrequently are used also during the summer season.

Timber and grassland areas occupy the highest elevations. The grasslands are usually mountain meadows having a high density of grasses, weeds, shrubs and half-shrubs. Such areas support an association of brome-grasses, fescues, mountain timothy, pinegrass, and a large assortment of broad-leaved weeds. These grasslands are usable only as summer grazing lands and have the greatest density and highest grazing capacity per unit area of any class of public lands in the basin. Needless to say that most surveyed lands of this type have long ago passed into private ownership or have been withdrawn from entry.

Timbered areas comprise plateaus, ridges or slopes receiving adequate rainfall for timber production. Most of these forested areas are within national forests. Principal tree species, in the Big Horn Mountain upper altitudes and in those of the Absaroka and Shoshone Mountains, include lodgepole pine, Engelmann's spruce, Douglas fir and quaking aspen. Some western yellow pine occurs along the lower slopes of the Big Horn Mountains. There is often an understory of palatable weeds, grasses and shrubs in forested areas, especially in quaking aspen cover. On the other hand, dense stands of conifer timber support little or no undergrowth of palatable forage species.

Prior to the beginning of controlled use of the unreserved public lands in 1934 and in 1935, there was heavy abuse of the range in many areas of the Big Horn Basin. This abuse was not caused by any one class of livestock, but by all classes--cattle, horses and sheep, and not infrequently a given range was used heavily by two, or even by all classes either during the same or different periods of the year. This over-use and improper seasonal use caused heavy damage to the vegetative cover, the soils and the watershed in those areas of greatest competition and also in areas that were suited only to limited use due to unfavorable soils, slope, topography and climate. In many such areas the most palatable native vegetative species were wholly or partially killed out to be later replaced by less desirable plants having lower grazing value.

Soils

The soil classes and types common to the basin are extremely varied, a fact closely associated with the formation of soils under different conditions as related to parent material, climate and topography. At the lower elevations the soils vary from badlands, not suitable to cultivation or grazing, to level or gently rolling bench land with a high productive capacity. A similar situation is evidenced in upland areas that are used principally for the grazing of livestock. Some upland area soils are productive of native forage and require a minimum of management control, while others are relatively unproductive and in addition are highly susceptible to erosion, necessitating many restrictions. In the upper headwaters of the major tributaries of the Big Horn River the soils are characterized as mountain soils, generally consisting of greyish-brown loams which are often stony and shallow. The mountain soils are generally highly productive of native forage or of brush or tree growth.

Generally, the soils of the basin as a whole can be subdivided into three broad groups based largely on topography and elevation. These consist of soils of mountainous and rough lands, comprising about 40 per cent of the basin; upland soils, 50 per cent and bottom lands and generally level stream terraces the remaining 10 per cent. The lands under the supervision of the Bureau of Land Management fall into all three classes, but by far the greater part consist of upland soils, with mountain lands and bottom lands next in order of area covered.

The upland soils are characterized by shallow, stony loams, grey-brown loams and by Pierre alkali clays and loams. They are residual, generally having been developed on shales. They are readily distinguished by their uneven surface and shallowness, often occupying the inter-stream divides of Big Horn River tributaries. They occupy extensive areas on either side of the Big Horn River, below the base of the mountains. The Pierre alkali clays and loams are to be found immediately adjacent to the bottom lands and alluvial benches on both sides of the river, near Worland. Soils of this type are generally underdeveloped or at best poorly developed and have a high erosion potential. Of the total upland soils in the Big Horn Basin under supervision of the Bureau of Land Management, it is estimated that at least 75 per cent are now or are potentially erosion problem areas, while the other 25 per cent of the lands do not present complicated erosion problems at this time.

Although the mountain soils in Big Horn Basin are mostly within the boundaries of national forests, small areas of such soils comprise the public domain lands under the administrative supervision of the Bureau of Land Management. These soils are derived from the igneous rocks of the mountain areas; made up of granite, schist, gneiss and other intrusive rocks. They are mostly grass and timber covered and consist of greyish-brown loams or sandy loams and frequently are stony and shallow. Because of the greater volume of vegetative growth, these soils contain more

humus than any other soil group in the basin. Except for the areas of steep slopes, canyons and dense tree growth, the mountain soils are productive of an abundance of forage, restricted to summer and fall use by deep snows and severe winter weather. Erosion problems are relatively minor on soils of this group and when present they are confined mainly to steep slopes and canyons having exposed surfaces.

The soils of the bottom lands and stream terraces are of alluvial formation and vary in texture from gravelly-sand, to clay with sand, to gravelly-subsoils. They are characterized by a horizon of lime from 8 to 24 inches below the surface, with sand and gravel beds often occurring at depths from 30 to 50 inches. Except where sub-irrigated, the lands in this group produce a scant amount of native vegetation and because of the loose, sandy nature of the surface soils and also the subsoils, they are subject to erosive action of both wind and water. Most of the lands of this type are in private ownership.

The bottom land soils that are mostly under private ownership, have been rather extensively covered by two soil surveys by the U. S. Bureau of Chemistry and Soils in cooperation with the University of Wyoming Experiment Station. They are reported in two bulletins entitled, "Soil Survey of the Basin Area, Wyoming", 1928 and the "Soil Survey of the Shoshone Area", 1927. The basin report covers an area of 426,240 acres adjacent to the Big Horn River and its tributaries from Worland to Greybull. The Shoshone report covers an area of 567,040 acres mainly in the Shoshone River drainage below Buffalo Bill Dam and including parts of Pole Cat, Sage and Whistle Creek drainages and the Oregon Basin. These reports, with their accompanying maps, supply detailed soil classifications for the areas covered.

Fur-bearing animals and the grazing resources of the Big Horn Basin were largely responsible for its early exploration and eventual settlement, although mining also played some part. It was through fur trade that the basin was first visited by white men and eventually became known to the world. The Verendryes, in 1742-43, in their search for a water passage to the west traversed the Big Horn Basin from north to south and back again. The Lewis and Clark Expedition in 1803-04, however, was the entering wedge to the fur trade in the Upper Missouri country and the mountains to the south. On the return journey Clark visited and described the lower course of the Big Horn River and upon his return to St. Louis he became associated with the first American fur company to operate on the Yellowstone and Big Horn Rivers. John Coulter, a member of the Lewis and Clark party was, so far as is known, the first white man to cross the mountains to the south and enter Big Horn Basin. The Big Horn River assisted in providing water transportation from the heart of the fur territory to St. Louis, but because of obstacles this route never became a common highway for fur traffic. Trapping and fur trade continued to be an important business, however, until about the time of the California gold strike in 1849, after which many ventures in mining were made in and around the Big Horn Basin. Since little early success was had in mining, few attempts were made after about 1870 until the "boom" of the "90's" 1/.

By 1878, the southern and eastern Wyoming ranges were within easy trailing distance from the Union Pacific Railroad and these lands were grazed by 250,000 to 300,000 cattle. In about 1880 cattlemen began to make explorations of the grazing lands of Big Horn Basin. Within a period of five or six years from 1879 or 1880, the cattle industry on the high plains expanded to include all of the Big Horn Basin, to which few herds were driven after about 1883 or 1884. U. P. Noble was the first cattleman in the Tensleep region, entering the basin from the south in 1880. In about 1881, Captain Robert A. Torrey of Fort Washakie secured land, later known as the Embar Ranch, and placed the first cattle in the Owl Creek area. A claim and a cabin erected here by J. D. Woodruff in 1871, believed to be the first cabin in the basin, were the nucleus for Captain Torey's ranch. Woodruff had brought a band of sheep to Owl Creek from Oregon, probably the first sheep to enter the basin. It appears that from 1879 to 1884 the basin was completely saturated with cattle. 1/

Until completion of the Northern Pacific Railroad in 1883, all Big Horn Basin cattle were shipped to eastern markets via the Union Pacific Railroad necessitating long drives southward, but after 1883 they were

1/ Charles Lindsey - The Big Horn Basin, 1932.

generally shipped via the Northern Pacific Railway from loading points in the Yellowstone Valley. The severe winter of 1886-87, caused such heavy cattle losses by starvation and freezing that the cattle business in the basin was temporarily on the decline. Numbers were again increased in the early "90's", however, and the quality of the livestock was improved. Some hay was being harvested from small irrigated farms for carrying herds over bad periods of winter weather.

Farmers began to settle lands adjoining the creeks and to produce crops under irrigation, especially hay. At about this time sheepmen also learned of the value of native forage in the Big Horn area and many herds arrived, with others on the way, to compete with the cattlemen and the farmer. Charlie Worland is believed to have been the first sheepman to attempt to raise sheep extensively in Big Horn Basin. The Mormon trek from Utah to outlying areas during the 1890's, however, is credited with the greater promotion of sheep production in the basin, since most caravans brought small flocks with them. By the turn of the century there were large numbers of sheep, some of the old cattle ranches having been converted into sheep ranches. Estimates have been made that some 70,000 sheep ranged near Meeteetse in the late "90's", and one operator is reported as selling 24,000 pounds of wool in 1899, receiving 12½ and 15 cents a pound for each of two sales.

Strife and conflict among cattlemen, sheepmen and small settlers or homesteaders became so great in the basin and adjoining areas that the notorious Johnson County War took place in 1891-92, after which cattle decreased and sheep increased in number and ranchers gradually became more and more dependent on hay for feeding during emergency periods in the winter. In 1905, Governor Brooks, recognizing a change in livestock operations in the state said, "Today our cattle are owned by 5,000 different stockmen and farmers instead of a few hundred outfits." Conflicts between cattlemen and sheepmen continued, however, for at least 10 years after the turn of the century.2/.

The Big Horn Basin is sparsely populated, with the areas of greatest agricultural development supporting the greatest number of people. Information from the 1940 census indicated the basin population to be about 34,000 persons, all of which was classed as rural except the population of Worland and Cody, the only towns with more than 2,500 inhabitants. Other towns of more than 1,000 population are Powell, Thermopolis, Lovell, Greybull and Basin. Since 1940 the basin has had an increase in population by an estimated 25 to 30 per cent. On the basis of this estimate the population at this time is more than 42,000 people, or about 3.5 persons per square mile. The principal population increases appear to have been in the larger towns, some of which, according to local population estimates, have nearly doubled in size since 1940. Increased agricultural production, oil and gas activities, tourist trade and merchandising have largely accounted for the

2/ Wyoming Cattle Trails, John K. Rollinson, limited edition 1948.

population increase. Business people and others throughout the basin are generally of the belief that the next few years will witness even greater strides in business and population development than have been made to date because of apparent expansion possibilities in the agricultural, oil and gas industries.

In the early 1900's, irrigation in the basin began on a big scale with the construction of the Hanover Canal near Worland in 1903. This was only one of many private irrigation enterprises that were started at about that time. Also the Bureau of Reclamation, in 1905, began the construction of Buffalo Bill Dam on the Shoshone River for power and irrigation purposes. With increased irrigation came more farming, not only the raising of more hay and feed crops, but also cash crops, such as sugar beets, beans, seeds of various types and others. The feeding and fattening of livestock became important in sugar beet areas. At present large numbers of livestock are fattened in Big Horn Valley, especially at or near Thermopolis, Worland, Powell, Basin, Greybull and Lovell.^{3/}

The C. B. & Q. Railroad was completed to Worland from the north in 1906, to Thermopolis in 1910, and to Casper in 1911-12. Today the basin is well supplied with transportation facilities including not only the Burlington Railroad north and south through the valley, together with a branch line serving Powell and Cody, but also bus lines, truck freight lines and an airline that serves Denver, Salt Lake City and Billings, making scheduled stops at most basin towns. Oiled highways cross the length of the basin and also extend east and west across Big Horn Mountains and to Yellowstone National Park.

The oil, gas and mining industry is exceptionally important and is discussed in further detail later in this report. This industry has also brought others, including oil well and pipeline supplies and heavy trucking operations. Public service utilities, commercial activities and social services have usually kept pace with the agricultural and mineral developments, but many rural areas lack telephones and electric power. Likewise, many county and local roads are not graded, although mail routes extend throughout the area with the exception of some of the least inhabited and most isolated localities.

Basin, Bridger, Cody, Greybull, Lovell, Powell, Thermopolis and Worland are all important agricultural and livestock centers. Worland and Lovell have sugar factories; Basin, Greybull and Powell are bean industry centers and have elevators and cleaning facilities for handling large quantities of Great Northern and Pinto dried beans. Cowley supports a vegetable canning plant which processes large quantities of canned peas, beans, corn and tomatoes and also freezes a considerable quantity of fresh peas, beans and corn for one of the leading frozen food companies.

^{3/} Senate Document No. 191, (April 1944).

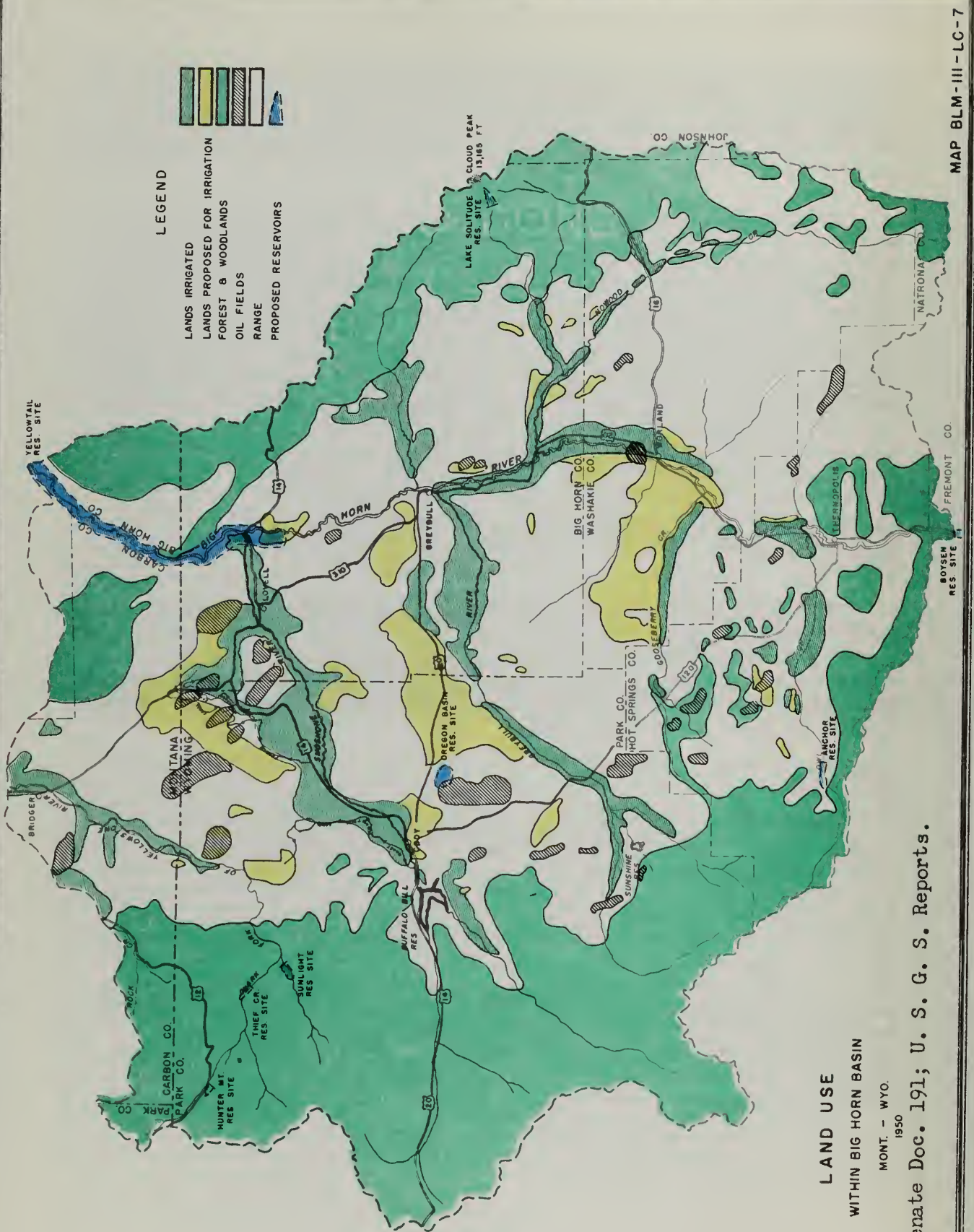
Greybull also supports a community cannery which processes sufficient quantities of fruits, vegetables and meats to supply many local families with their winter supply of canned goods. Worland, Powell and Greybull support livestock sales rings at which several thousand head of livestock are sold annually.

Thermopolis is a health and recreation center because of the presence of mineralized hot springs, one of which is reported to be the world's largest, having a daily flow reported as 16,800,000 gallons. Gebo and Kirby in Hot Springs County are producers of coal, while gypsum and sulphur are mined near Thermopolis. Gypsum, bentonite and sulphur are found in abundance in Big Horn County and in other portions of the basin. Creameries are located in Cody, Powell, Thermopolis and Worland. There are banks located in Lovell, Cody, Worland, Greybull, Basin and Powell. Oil refineries are located in or near Thermopolis, Worland, Lovell, Basin and Cody, (the Greybull refinery has been abandoned). Worland supports the only daily newspaper, while weekly papers are published in Basin, Cody, Greybull, Lovell, Powell and Thermopolis. Modern schools, churches and hospitals are to be found in all of the larger towns. During the last few years the increased populations have taxed existing school and hospital facilities to the limit.

The major industries are agriculture and petroleum, both of which have expanded rapidly since 1940. In agriculture the increased activity is associated with the irrigation development program of the Bureau of Reclamation. Expansion in production of oil and in processing facilities has come with the war and postwar demand which has indicated a critical need for this product.

Agriculture

Range livestock is the major agricultural industry in the basin with cattle production being more important than sheep. Major irrigated farm enterprises associated with range livestock ranching include the production of alfalfa hay, sugar beets and beans. The comparatively large proportion of land in the basin that is primarily suited for grazing use is the principal factor responsible for the importance of the range livestock enterprise. In 1943, about three per cent of the lands of the basin were cultivated and most of the remainder used for grazing. Land under cultivation is all irrigated. Crops from approximately 288,000 acres were harvested in 1948, hay crops making up 43 per cent of the total, grains 23 per cent, dried beans 21 per cent, croplands used for pasture 8 per cent, sugar beets 4 per cent and miscellaneous crops 1 per cent.



LEGEND

- LANDS IRRIGATED
- LANDS PROPOSED FOR IRRIGATION
- FOREST & WOODLANDS
- OIL FIELDS
- RANGE
- PROPOSED RESERVOIRS

LAND USE

WITHIN BIG HORN BASIN

MONT. - WYO.
1950

From: Senate Doc. 191; U. S. G. S. Reports.

The basin supports about 205,000 animal units 1/ of grazing livestock, of which cattle comprise about 123,000, sheep 67,000 and horses 15,000. A number of cattle and sheep are fattened in feed lots, where locally raised hay, grain and sugar beets are fed to them before they are sent to market. It is estimated that during the winter of 1946-47, about 14,000 head of cattle and 132,000 head of sheep were fattened locally. The feeding business is centered around the sugar beet industry, with ranches in the vicinity of Worland, Lovell and Powell being especially important in such feeding operations.

In lamb feeding, the general practice is to take the lambs as they come off the range in late summer or early fall and put them on alfalfa pasture, beet-top pasture or other irrigated pasture, for a few weeks to two months before they are placed in feed lots, in November or December. While in the feed lots they are on what is called "heavy feeding" for a period of 100 days or more. Feed used is mostly locally grown except for considerable corn which is often shipped in from Nebraska to supplement home grown rations. Other feed consists of alfalfa, beet pulp, molasses, (from local sugar beet factories), barley, wheat or oats, as available. In February or March the "top" or highest-conditioned animals are selected and sold as "fat" lambs in carload lots. When lambs are placed on feed they usually weigh about 70 pounds and when sold as fat lambs they weigh 90 to 120 pounds, thus gaining an average of about one-quarter to one-third of a pound per day.

Similarly "long" yearling steers weighing about 700 to 800 pounds are placed in feed lots from October or November for periods of 100 to 150 days on similar fattening rations. Average daily gain during feeding period is two to three pounds.

A typical livestock ranch requires a combination of irrigated lands and range resources which can provide a livestock feed supply throughout the year. Located in the valleys are the ranch headquarters where the irrigated crops are grown. Hay, mainly alfalfa, is the basic irrigated crop needed in the production of livestock. Hay is the principal food supply during the winter and the crop land is used as a source of pasture during the fall, winter and spring. The main complementary cash crops are sugar beets and beans which also provide some feed for livestock.

Seasonal livestock operations consist of feeding hay at the ranch during the winter months and running the livestock on the range during the spring, summer and fall. The feeding period varies with

1/ An animal unit is considered as one cow, one horse or five sheep.



Cattle feeding on beet tops in irrigated areas near Lovell, Wyoming. Irrigation agriculture is closely related to the range livestock industry and the winter feeding of range cattle and lambs is becoming an increasingly important enterprise



Range lambs turned in on beet fields during harvest in Big Horn Basin. Note unharvested beets in foreground. Sugar beets and beans are grown in rotation or cropping system in which alfalfa and sweetclover are the soil improving crops



Haying operations in Shell Creek Valley, Wyoming. Big Horn Range in background. Virtually all of the range lands are Public Domain, the portions adjacent to irrigated lands being used for winter range and the rougher mountainous sections being used for spring, summer and fall range. The latter area provides excellent habitat for wildlife use during winter months.

climatic conditions. The spring and late fall range is composed mainly of the grazing lands under the control of the Bureau of Land Management. Such lands are located in the more arid sections at the lower elevations where the vegetative cover is sparse and where there is feed only during the spring and fall wet seasons. During the summer the livestock are driven to the more productive grazing areas, located at higher elevations, which are generally within the National Forest boundary. In the late summer or early fall the livestock may either be placed on public domain range for a few weeks or brought to ranch headquarters to pasture on meadows and crop aftermath.

It is the general practice for cattle operators to raise steers to sell as long yearlings or as 2-year-olds. Not infrequently, however, calves are sold, especially during periods of exceptionally favorable prices. Good long yearlings weigh from 700 to 800 pounds and calves weigh from 350 to 400 pounds. Cattle are usually marketed as feeders in late September or October, the principal market being Nebraska, Kansas and Colorado. Fattened cattle go to Denver, Omaha, Kansas City and other eastern points with a small percentage going to California, Casper, Wyoming and Billings, Montana.



Typical sheep feedlot on irrigated farm in the Big Horn Basin

In the sheep ranching type of farming, the ewes are usually shed-lambbed in March or April, although there is some range lambing in May. Shearing may precede or follow lambing, depending upon weather conditions, availability of labor and other factors. The average fleece weight is from 8 to 10 pounds. Lambs are usually sold as feeders from late July through September and normally weigh 70 to 85 pounds. A small percentage of the "tops" are sold to packers as fat lambs. A considerable number of ewe lambs are kept during the winter and are sold in the spring or fall as herd replacement stock.



*Oil wells in Elk Basin Field north of Powell, Wyoming.
Virtually all lands shown are Public Domain.
Elk Basin Field is largest oil producer in Wyoming,
exceeding 4 1/2 million barrels in 1949*

Mineral Deposits

Of prime importance, economically in the Big Horn Basin, is the production of petroleum and natural gas. In the foothills at the base of the mountains surrounding the basin, rocks underlying the Tertiary beds are exposed, showing many geologic structures such as anticlines, domes, etc., which form traps for the accumulation of oil and gas. Many have been prospected and oil and gas obtained from several horizons. There are about 59 structures now producing or capable of producing either oil, gas or both.

Most towns of the basin are provided with natural gas for domestic use through an extensive network of pipelines interlacing the basin. Some is used industrially and to serve the refineries. Gas is also piped to Montana points, including Billings and Laurel. Natural gas produced in the Big Horn Basin in 1945, was in excess of 7,860,000,000 cubic feet.

Petroleum is piped from most of the producing fields to Billings, Montana, Casper, Wyoming and other points, as well as to local refineries. Other fields are connected by pipelines to points on the railroad and large volumes are shipped by rail and truck. At some of the smaller producing structures the oil is loaded into storage tanks and from there hauled to the local refineries located near Thermopolis, Worland, Lovell, Cody and at Elk Basin. Some of the petroleum, heavy, black oil, is used with little or no refining as road oil.

The beginning of the oil industry dates back to 1888, when the first oil well was drilled, however, no discovery of importance was made until about 1905 and the industry was rather insignificant until after 1910. Expansion was considerable between the period 1910 to 1920, with several oil fields being discovered and since 1940, the expansion has been rapid. For example, in 1940, the Big Horn Basin produced 24 per cent of the total Wyoming State production; in 1947, almost half the production of the state was attributed to the Big Horn Basin. The daily oil production in mid-1947 was about 61,000 barrels, exceeding the local refining capacity by more than 38,000 barrels. Seven oil refineries were operating in the basin in 1949.

The 1948 production of oil, reported by the State Board of Equalization, totals 27,407,306 barrels, equal to one-half the total production of the State of Wyoming for that period. Out of 43 oil fields, all except 14 showed gains in production over 1947. The year 1949, showed a slight decrease in total production in the basin due to a lessening demand for black oils. Production in the basin in 1949, totalled 26,700,000 barrels in Wyoming and 2,350,000 barrels in Montana. Elk Basin retains its title as Wyoming's biggest producing field, for the second year, with 1949 production totalling 4,791,000 barrels.1/.

Practically the entire Big Horn Basin is undergoing thorough exploration for oil possibilities by means of the most modern geophysical methods and it is problematical as to the extent to which the oil and gas industry may influence the future economy of the basin and of the States of Wyoming and Montana. Thirty-eight domes, or fields, are shown on the map of this area. (See map appendix) Several new fields have been opened up for production during the past year and a number of new producing wells have been brought in.

1/ Compiled from U. S. Geological Survey reports.

Coal is widely distributed over the flanks of the basin. The Gebo and Bear Creek Mines are the heaviest producers, shipping 656,497 tons by rail in 1945. "Wagon Mines" produced 56,897 tons that year for local consumption. Much coal was used at the mines for various purposes and the total production amounted to 721,940 tons.

Bentonite, another bedded mineral, occurs in the Cretaceous Mowry shale which outcrops in many places around the perimeter of the basin. Though the outcrops are covered by mining claims, the beds usually have a steep dip, or the overburden is heavy, making mining expensive. Some bentonite has been mined, but in general little exploitation has as yet occurred.

Gypsum, practically undeveloped except in one or two localities, is rather widely distributed around the perimeter of the basin. It is reported of good quality, but has little market value. It is mined sporadically at a few points.

Other minerals in the basin include limestone which is mined for sugar factory use at Warren, Montana, sulphur, (near Thermopolis and Sunshine, Wyoming), sand and gravel, cement materials and building stone, of which a small amount is being produced near Thermopolis, Wyoming.

Two commercial sulphur deposits are in the basin, one about $3\frac{1}{2}$ miles northwest of Thermopolis, Wyoming and the other 3 miles west of Cody, Wyoming. The total production from both deposits approximates 9,000 tons, most of which is shipped to Spokane, Washington. Reduction plants have been constructed in both the Worland and Elk Basin oil fields for recovery of sulphur and other products from waste gases that were formerly burned. The Cody refinery is producing an asphaltum membrane lining material that is used to stop seepage in irrigation canals and to waterproof basements.

Recreation and Wildlife

The basin is located within a region that has abundant natural resources for outside recreation. It is located adjacent to Yellowstone and Grand Teton National Parks and the Jackson Hole National Monument. The Cody, Wyoming gateway to Yellowstone National Park is second only to the west entrance as the route of heaviest traffic into the park. In addition to the National Parks which comprise the most popular tourist attractions, all of the mountains in this general region have tourist significance and importance because of their scenic, hunting, fishing and other recreational opportunities. The Big Horn and the Owl Creek Mountains, as well as the Shoshone and Absaroka Ranges abound in big game, fishing streams, lakes, timber, scenic campsites and even wilderness areas which can be reached only by pack trips. These are sufficiently important in themselves to attract many recreationists and

tourists. Summer camps and dude ranches afford limited accomodations.

Deer, elk, bear, moose and mountain sheep inhabit the higher mountain areas, although deer and some elk are found in foothill areas at low elevations throughout the year. Most deer migrate in winter to areas of low snowfall, where most of the public domain lands are situated. Antelope are plains animals and are found in the lower plateau or plains areas throughout the year. Estimates of big game animals in the report area include 18,000 mule deer, 9,000 elk, 3,500 antelope, 800 mountain sheep, 260 moose and 500 bear. These estimates of wildlife populations are based on reports made by representatives of various Federal and state land and game management agencies. In addition to big game animals there are numerous fur-bearing animals such as badger, beaver, fox, martin and muskrat. Predators such as bobcat, linx, coyote and mountain lion are found throughout the basin in relatively small numbers. Also considerable numbers of upland game birds including sage grouse, sharp-tailed grouse and pheasants inhabit the basin area.

Lumbering

Lumbering is a comparatively minor industry in the basin. No extensive timber cutting or marketing operations are conducted, although several small lumber mills are located in the National Forests. Annual timber sales in the Big Horn and Shoshone National Forests are estimated to average about $2\frac{1}{2}$ million feet, board measure.

A few small timber sales are made each year from lands under the control of the Bureau of Land Management and from small tracts of privately-owned lands. The bulk of all timber sales comprise lodgepole pine, Engelmann spruce and Douglas fir, largely for local use. Lodgepole pine is mainly sold as poles for ranch and farm use. In addition to timber sales, the area supplies considerable amounts of firewood, posts, poles and saw timber, which is permitted, upon application, to be cut from public lands by local settlers and residents for domestic use without charge. During the past year free-use permits have been issued by the Bureau of Land Management for 15,000 feet of lumber, 1,400 poles and posts and 360 house logs. During the same period sales have been made of 1,623,000 feet of saw timber, (mostly Douglas fir), 3,000 poles and posts and 250 house logs.

LAND OWNERSHIP

As illustrated by the map which accompanies this report and as shown in Table No. 3, page 33, the gross area of the Big Horn Basin is 8,745,820 acres, of which 88 per cent is located in Wyoming and the remaining 12 per cent in Montana. Seventy-one per cent of the entire area is in Federal ownership or under Federal management. The Department of Interior has jurisdiction over 4,150,688 acres of this land, while the remaining 2,026,804 acres consist of National Forests administered by the Forest Service of the Department of Agriculture.

The three principal agencies of the Department of Interior which administer lands in the basin are the Bureau of Land Management, Bureau of Indian Affairs and the Bureau of Reclamation. A small area, 208 acres, is contained within the Shoshone Caverns National Monument, which is administered by the National Park Service. The Bureau of Land Management administers a total of approximately 3,501,649 acres of land or nearly 40 per cent of the entire report area. About 90 per cent of these lands are situated within three grazing districts and include not only vacant, unappropriated public domain, but also various types of land withdrawn for special purposes. The term "withdrawal" is derived from the fact that the lands are withdrawn from entry, selection or other appropriation under appropriate public land laws enacted by Congress. These withdrawals are made under the inherent authority of the President, or under provisions of the general Withdrawal Act of 1910, by special legislation establishing particular fields of activity and by special acts of Congress withdrawing specific areas for designated purposes.

Examples of special legislation establishing particular fields of activity for the furtherance of which authority is given to withdraw portions of the public domain include the Reclamation Act of 1902 and the Stockraising-Homestead Act of 1916. The Reclamation Act authorized the Secretary of Interior to withdraw areas needed for the construction of reclamation works and for the establishment of irrigated farm units. Lands withdrawn for reclamation purposes are of two types: "first form" and "second form". First form withdrawals, which involve lands needed for construction and maintenance purposes, withdraws land from all forms of surface entry and suspends the operation of mining laws, except in such instances as the Secretary of Interior finds appropriate. Second form withdrawals, which involve lands classified as suitable for irrigation, are placed into farm units when water is made available and are open to homestead entry under reclamation laws. Approximately four per cent of the entire area (346,521 acres) consist of lands withdrawn for reclamation purposes. Slightly more than one-half of these lands are administered by the Bureau of Land Management under cooperative agreement with the Bureau of Reclamation. Some of the lands shown in Table No. 3, which are classified as water surface, are reclamation withdrawals which are inundated by the Buffalo Bill Reservoir. The Stockraising-Homestead Act authorizes the Secretary of Interior to withdraw lands for the establishment of stock-driveways to be used for the

movement of livestock. A total of 114,182 acres are withdrawn for stock-driveway purposes, most of which are located outside of grazing districts.

About six per cent of the entire area is comprised of lands within the Crow Indian Reservation in Montana and the Wind River Reservation in Wyoming, under the administrative jurisdiction of the Bureau of Indian Affairs.

Three National Forests, Custer in Montana and the Big Horn and Shoshone in Wyoming, embrace a net area of 2,026,804 acres or 23 per cent of the report area. These forests, created largely from the public domain, are managed for the protection of watersheds under policies of integrated use of all resources—timber, forage, water, wildlife and recreation.

Five per cent of the gross area within the Big Horn Basin is comprised of lands administered and owned by the States of Montana and Wyoming. State lands in Wyoming comprise 407,082 acres; in Montana 27,925 acres. Virtually all of the State lands within the Montana portion of the basin are located within the boundaries of Montana Grazing District No. 4; while 369,080 acres of the State lands in Wyoming are located within Wyoming Grazing Districts No. 1 and No. 2. Hot Springs State Park at Thermopolis, Wyoming is State-owned and embraces 640 acres.

Lands in private ownership embrace 24 per cent of the entire basin and comprise 2,117,221 acres. Most of these lands are agricultural in nature and were disposed of chiefly under various public land laws, which required cultivation, improvement or other activities on the part of the entryman leading to the development of a self-sustaining farm unit. Minerals, including oil and gas, are reserved by the Federal Government on much of the lands which have passed into private ownership. It is of significance to note that the vast bulk of the private lands are situated in areas of perennial stream flow or within areas of irrigation development with comparatively little of the low-lying grazing lands in the basin proper being in private ownership. Generally the purpose of private land ownership within the basin was to own crop and hay lands, irrigated pastures, choice range areas and waterholes as a means of controlling the use of adjoining public domain range lands.

Intermingled as they are with privately-owned lands, the public lands are of vital importance to the economy of the basin. It is estimated that 90 per cent of the landowners engaged in livestock operations in the basin are directly dependent upon public range to insure a stable livestock economy.

Table 3.- Classification of land ownership: Acreage by counties within the Big Horn Basin Report Area, Wyoming and Montana, 1950 ^{1/}

Class of Ownership	W y o m i n g						M o n t a n a			Total				
	Big Horn	Fremont	Hot Springs	Johnson	Natrona	Park	Washakie	Total	Big Horn	Carbon	Park	Total	Report Area (Acres)	Report Area (Percent)
Bureau of Land Management														
Public Domain	1,076,144	7,362	478,612	1,506	4,637	480,927	890,318	2,939,506		222,348		222,348	3,161,854	36.2
Power Site	16,813		2,235			6,999	79	26,086		3,770		3,770	29,856	.3
Public Water Reserves	1,104		1,318			629 5/	590	3,641		1,402		1,402	5,043	.1
Stock Driveways	24,112 1/		3,151	623	1,850	44,571	39,875	114,182					114,182	1.3
Material Site						160		160					160	*
Airport Lease	351						319	351					351	*
Administrative Site								319					319	*
Carey Act	896							896					896	*
Oil Reserves	80							80		120		120	200	*
Army Target Range	3,534							3,534					3,534	*
Reclamation Withdrawals 2/	77,160		549					185,254					185,254	2.1
Bureau of Reclamation 3/	30,753							160,707		560		560	161,267	1.8
Bureau of Indian Affairs (net)									250,900			250,900	250,900	2.9
Crow		4,480	220,680					225,160					225,160	2.5
Wind River														*
National Park Service								208					208	
National Forests (net)														
Custer	356,106		53,355	18,860		1,337,169	34,814	409,780		192,980	33,520	226,500	226,500	2.6
Big Horn								1,390,524					409,780	4.7
Shoshone													1,390,524	15.9
State Lands	75,854	1,080	74,007 10/	110	3,449	158,209	94,373	407,082		27,925		27,925	435,007	5.0
Railroad Lands (Northern Pacific)						16,100		16,100					16,100	.2
Private Lands 4/	355,076	8,257	396,168	17,260	25,890	708,550	329,443	1,810,644		276,577		276,577	2,117,221	24.3
Water Surface 5/	3,792		803			6,863	46	11,504					11,504	.1
County Total	2,021,775	21,179	1,230,878	38,359	35,826	2,997,844	1,389,857	7,735,718 88.5%	250,900	725,682	33,520	1,010,102 11.5%	8,745,820	100.0
														100.0

^{1/} Data compiled from records of Bureau of Land Management, Billings, Montana. For location of various land classes refer to map accompanying this report.

^{2/} Administered by Bureau of Land Management by agreement with Bureau of Reclamation. Management by Bureau of Land Management ceases when these lands are needed by Bureau of Reclamation for construction or development purposes.

^{3/} Item ^{2/} above should be added for total Reclamation Withdrawals.

^{4/} 27,430 acres of private lands are within National Forests and 20,828 acres within Indian Reservations.

^{5/} Lands inundated by existing reservoirs and rivers, primarily under Federal jurisdiction.

^{6/} 240 acres classed Public Water Reserve and Stock Driveway.

^{7/} 422 acres classed Stock Driveway and Material Site.

^{8/} 114 acres classed Reclamation Withdrawal and Stock Driveway.

^{9/} 3,693 acres classed Reclamation Withdrawal and Stock Driveway; 960 acres classed Reclamation Withdrawal and Power Site.

^{10/} Includes 640 acres in Hot Springs State Park at Thermopolis, Wyoming.

* Less than 0.1%

Table 4.- Relationship of lands administered by the Bureau of Land Management with other land classes:
by areas of responsibility within the Big Horn Basin, Wyoming and Montana, 1950 (acres) 1/

County	Within Grazing District		Vacant	Other With- drawals	Northern Pacific Railroad	State	Private	Water Surface	Total
	State	District							
Big Horn Hot Springs Park Washakie Carbon Fremont	Wyoming	W-1 2/	1,076,144	154,803		75,854	354,436	3,792	1,665,029
	Wyoming	W-1 2/	421,356	4,102		51,080	255,188	443	732,169
	Wyoming	W-1 2/	220,057	206,285	15,982	123,700	471,800	6,355	1,044,179
	Wyoming	W-1 2/	881,805	39,821		90,079	283,739	46	1,295,490
	Montana	M-4 2/	221,828	5,852		27,285	270,697		525,662
	Wyoming	W-2 3/	7,362			1,080	8,257		16,699
Subtotal	Total within Districts		2,828,552	410,863	15,982	369,078	1,644,117	10,636	5,279,228
Carbon Hot Springs Washakie Park Johnson Natrona	Outside Grazing District								
	State	District							
	Montana	M-6 4/	120	3,151		640	5,880		6,640
	Wyoming	W-1 2/	57,256	1,042		22,927	119,332	360	203,026
	Wyoming	W-1 2/	8,513	5/ 83,741	118	4,294	44,944		58,793
	Wyoming	W-1 2/	260,870	623		34,509	210,900	508	590,646
Subtotal	Wyoming	W-2 3/	1,506	1,850		110	17,260		19,499
	Wyoming	W-2 3/	4,637			3,449	25,890		35,826
	Total outside Districts		332,902	90,407	118	65,929	424,206	868	914,430
Grand Total	Big Horn Basin Total		3,161,454	501,270	16,100	435,007	2,068,323	11,504	6,193,658

1/ Data secured from records, Bureau of Land Management, Billings, Montana. For location see accompanying map.

2/ Administered by Range Manager, Wyoming-1, Worland, Wyoming.

3/ Administered by Range Manager, Wyoming-2, Lander, Wyoming.

4/ Administered by Range Manager, Montana-6, Lewistown, Montana.

5/ Includes 208 acres - Shoshone Cavern National Monument, administered by the U. S. Park Service.

Table 5.- Classification and distribution of Federal land ownership
by major watersheds in the Big Horn Basin,
Wyoming and Montana, 1950 1/

	Big Horn River (Acres)	Clark Fork of the Yellowstone River (Acres)	Total (Acres)
Within Grazing Districts			
Vacant	2,670,437	158,115	2,828,552
Other Withdrawals	285,152	3,095	288,247
Northern Pacific Railroad	15,982		15,982
Private	1,444,958	199,159	1,644,117
State	362,063 <u>2/</u>	7,015	369,078
Water Surface	10,636		10,636
<u>Subtotal</u>	<u>4,789,228</u>	<u>367,384</u>	<u>5,156,612</u>
Outside Grazing Districts			
Vacant	300,934	32,368	333,302
Other Withdrawals	182,661 <u>3/</u>	30,362	213,023
Northern Pacific Railroad	395,754	77,350	473,104 <u>4/</u>
State	48,591	17,338	65,929
Water Surface	868		868
<u>Subtotal</u>	<u>928,926</u>	<u>157,418</u>	<u>1,086,344</u>
Bureau of Indian Affairs (net)	476,060		476,060
National Forests (net)	1,352,604	674,200	2,026,804
Total	7,546,818	1,199,002	8,745,820

1/ Data secured from records of Bureau of Land Management, Billings, Montana.

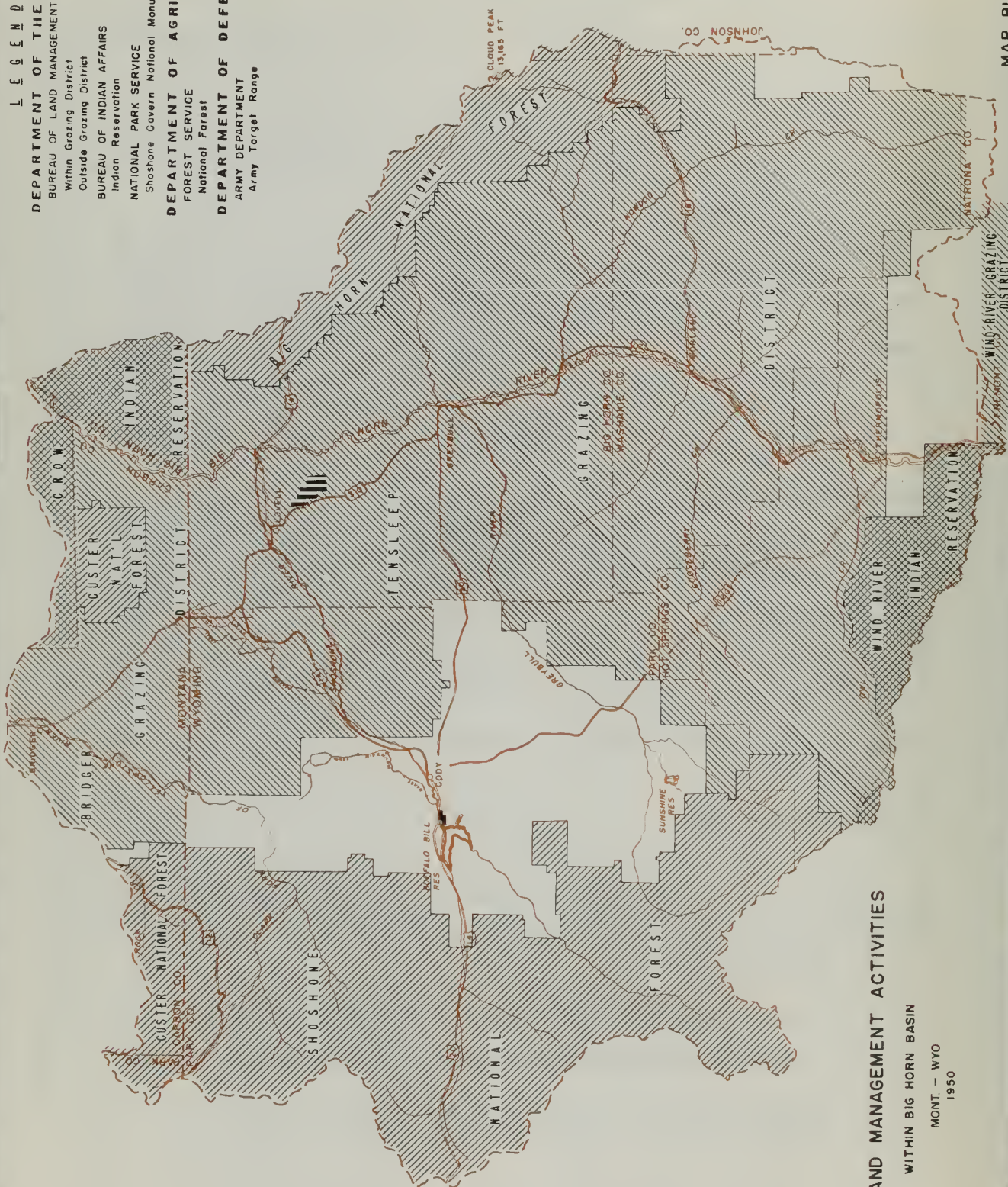
2/ Includes 640 acres State Park, Thermopolis, Wyoming.

3/ Includes 208 acres Shoshone Cavern National Monument.

4/ Private lands in National Forests (27,430 acres) and Bureau of Indian Affairs (20,828 acres) included.

LEGEND

- DEPARTMENT OF THE INTERIOR**
BUREAU OF LAND MANAGEMENT
 Within Grazing District
 Outside Grazing District
BUREAU OF INDIAN AFFAIRS
 Indian Reservation
NATIONAL PARK SERVICE
 Shoshone Govern National Monument
DEPARTMENT OF AGRICULTURE
 Forest Service
 National Forest
DEPARTMENT OF DEFENSE
 Army Department
 Army Target Range



MAJOR LAND MANAGEMENT ACTIVITIES

WITHIN BIG HORN BASIN

MONT. - WYO

1950

LAND MANAGEMENT PROGRAMS

Bureau of Land Management

Within the Big Horn Basin there remains approximately 3,161,854 acres of "vacant, unappropriated and unreserved" public land. Of this acreage, 2,828,552 acres are within three grazing districts, established pursuant to the Taylor Grazing Act of 1934 and 333,302 acres are outside of grazing districts. Most of the latter is distributed within Park and Hot Springs Counties, Wyoming.

Ninety per cent of the lands administered by the Bureau of Land Management, including various withdrawals, are located within grazing districts. The grazing districts were established pursuant to the Taylor Grazing Act approved June 28, 1934, as amended, which is far more than an Act for the regulation of grazing. It provides for a comprehensive administrative authority to insure that the purposes of the public land laws are fully served and that the laws providing for the disposition of public lands do not adversely affect land development and conservation policies of the Government. The Taylor Grazing Act, as amended, gave recognition in law to the fact that the greater part of the remaining unreserved public domain was not suitable for settlement under the various homestead laws. It provided that land which is chiefly valuable for grazing should no longer be a "free grazing commons"; but should be regulated and administered by the Government in a manner to develop and conserve the natural resources and to stabilize the grazing use, giving preference to the owners of land engaged in the livestock business, who are dependent upon the public lands for the proper use of the land and water owned by them. The Act also provided that no vacant, unappropriated public domain was subject to disposition, settlement or occupation until after the same had been classified and opened to entry. Management of the grazing resources in the grazing districts is accomplished through regulated grazing use, authorized through a system of grazing permits issued to stockmen residing in or near the districts. It is of interest to note that 65 per cent of all lands within the grazing districts are under the administrative jurisdiction of the Bureau of Land Management. Grazing privileges are granted with a view to the protection and development of livestock operations that are recognized as established and which normally involve the use of the public range in a regular and continuing manner each year. Permits for such grazing use are ordinarily issued for a period of ten years, subject to modification or cancellation under certain conditions. Approximately 52,000 cattle, 1,900 horses and 276,000 sheep, or a total of 109,100 animal units, obtained seasonal grazing on grazing district lands in 1949.

Public domain grazing lands outside of grazing districts are leased under Section 15 of the Taylor Grazing Act, with preference being given to adjoining landowners. Leases are ordinarily for a

period of ten years, but may be for a shorter period, depending upon the location, amount and permanency of the lessee's holdings. The lessees obtain exclusive use under prescribed conditions of the leased land for grazing purposes. Lands leased for grazing purposes under Section 15 of the Taylor Grazing Act, comprise a total of 268,464 acres within the Big Horn Basin.

Exclusive of National Forests and Indian Reservations, approximately six per cent of all public lands are in various forms of withdrawal for special purposes, such as power sites, public water reserves, stock-drive-ways, reclamation, military and others. Approximately 57 per cent of these withdrawn lands are located within grazing districts. Lands withdrawn for power purposes comprise 29,856 acres and most of such lands are located adjacent to the larger streams in the basin. These reserves are recorded in the land offices as power site withdrawals and the lands so withdrawn are administered by the Federal Power Commission under the authority of the Act of June 10, 1920. Section 24 of the Act provides that public land entries may be made upon these withdrawn lands, provided that the tracts applied for are first restored from the general withdrawal and the tracts entered or patented are subject to later use by the United States or its permittees for power purposes. The Federal Power Commission does not administer withdrawn areas as an administrative agency, its activities being more or less confined to the issuance of permits or licenses covering the construction of power plants and power developments. Under cooperative agreement with the Federal Power Commission, the Bureau of Land Management administers such areas for grazing purposes, under provisions of the Taylor Grazing Act. The agreement provides that upon the issuance, by the Commission, of a permit or license for power purposes any grazing use in conflict therewith must be considered automatically cancelled.

Public water reserves are another form of withdrawal which is administered by the Bureau of Land Management. Within the report areas, these reserves comprise a total area of 5,043 acres and are located both within and outside of grazing districts. Prior to the passage of the Taylor Grazing Act, when there was no regulation of unreserved public land, possession of watering places resulted in control over large areas of surrounding public grazing land. It became apparent, after stockraising enterprises were established in the basin, that public grazing lands would be monopolized by the larger interests through control of watering places, unless steps were taken to reserve such waters for the benefit of the public. In 1926, an Executive Order withdrew lands within one-fourth mile of any spring or waterhole on vacant, unappropriated and unreserved public land.

Reservations of public land for stock driveway purposes were authorized by Section 10 of the Act of December 29, 1916. Such lands cannot be



*Range cattle being moved along U.S. highway 14 east of Lovell, Wyoming
from summer range to irrigated feed lots in Big Horn Valley*



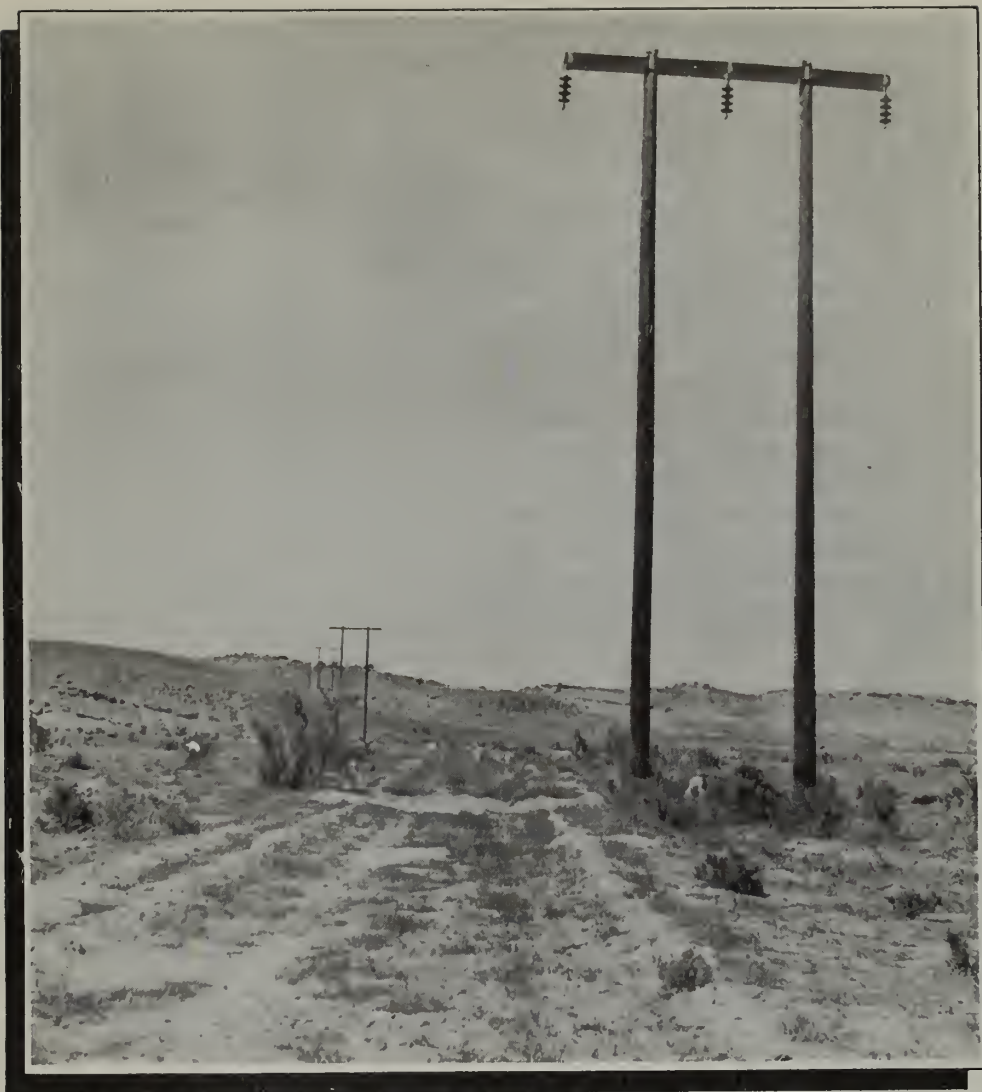
*Sheep moving on public stock driveways from summer to winter range
in the vicinity of Tensleep, Wyoming*

entered and all applications for making entry for lands so withdrawn are rejected. The primary purpose of these withdrawals is to provide access by the public to livestock watering places and for use in the movement of stock to summer and winter ranges, or to shipping points. These withdrawn lands are located both within and outside of grazing districts, but available information is inadequate to determine the extent of the use and need for these driveways. However, reconnaissance studies indicate there is a vital need for some of the driveways to be retained for trailing purposes, while in other areas it will be necessary to amend, vacate or re-locate a considerable number of them. In some portions the driveways are discontinuous and the purpose for which the lands were withdrawn is being defeated in other areas due to trespass and unseasonal use. These conditions may be attributable in part to the fact that there has been no administrative authority charged with the responsibility of regulation, management and administration of stock driveway lands outside of Federal grazing districts until recent years.

Comparatively small areas are withdrawn for other purposes. A 319 acre administrative site, near Worland, Wyoming, is withdrawn for use in connection with the District Office of the Range Manager, Bureau of Land Management. An area of 351 acres is withdrawn for airport purposes and leased to the town of Greybull, Wyoming. Eighty acres are withdrawn for petroleum reserves. Withdrawn Carey Act lands, which have not yet been developed for irrigation purposes, total 896 acres and a temporary withdrawal for an Army target range, located in Big Horn County, Wyoming, comprises 3,534 acres. Easements, or grants for right-of-way purposes upon or across public lands for canals, ditches, reservoirs, water pipelines, oil and gas pipelines, telephone-telegraph lines, roads, highways and material sites are provided for under existing law. Ingress or egress over public lands for all proper and lawful purposes is not restricted, providing they do not interfere with the proper administration of the public lands. Bureau of Land Management activities also include the granting of mineral leases and permits on most of the Federal land and on former public lands for which the Federal Government has retained mineral rights.

Cadastral surveys, which officially establish townships and section corners and which are essential to the identification of all land areas, are an important Bureau of Land Management function.

The management program for public domain, both within and outside of grazing districts, includes rehabilitation operations to decrease soil and moisture losses and to increase forage production and protection against range fires, rodents and insects. The conservation program on public grazing lands benefits the intermingled state and privately owned



*Bureau of Reclamation power line between Buffalo Bill Dam and
Boysen Dam near Grass Creek, Wyoming.
Note sheep grazing in foreground*

range lands. The soil and moisture conservation program on public land has as its main objectives the restoration, rehabilitation and protection of all land administered by the Bureau of Land Management which is in need of soil, water and vegetation conservation measures, beyond those supported by proper resource management; retardation of erosion, abatement of floods and reduction of silt flows as it relates to off-site as well as on-site benefits; continuation of such rehabilitation programs to provide for resource stability under proper use. The soil and moisture conservation work performed upon public lands administered by the Bureau of Land Management consists primarily of the use of proven, practical devices to slow down and stop further soil and water losses, and of procedures involving management and use of the

rehabilitated land to prevent a recurrence of deteriorating conditions. Some of the conservation practices include re-vegetation or grassing, or the replacement of inferior vegetation with species of greater value for the protection of soil and for grazing use; control of gullies through stream bank plantings, together with construction of diversion and silt-retention dams; flood-irrigation of range lands by water spreading devices; development of stock water supplies, such as reservoirs, springs or wells and construction of protective fences. Conservation planning and operations are organized on the basis of approved project areas of which there are four at the present time, all located within the grazing districts. Commensurate with the needs for rehabilitation work and in contrast to the vast areas of public land in the basin, these projects encompass a relatively small segment of the basin. In relation to the magnitude of the needs; the amount of rehabilitation work that has been completed on the public domain is insignificant. None-the-less, the modest though excellent, results which are being achieved in rehabilitating continually eroded public lands in the basin by means of various soil and moisture conservation practices, points the way for a more comprehensive rehabilitation program on critical areas throughout the basin.

The advisory board system established by Section 18 of the Taylor Grazing Act provides for cooperation with the users in the administration of public range lands. District advisors are elected by the users of the public range in each of the grazing districts and the Secretary of the Interior appoints wildlife representatives to each of the boards. The advisors make recommendations to the Bureau of Land Management on such matters as grazing capacity of the range, allotment of grazing privileges, rules of fair range practice, seasonal use of the range, construction of range improvements, protection of wildlife and other matters of mutual interest.

Bureau of Reclamation

The Reclamation Act of June 17, 1902, provided for the examination, survey and construction of irrigation works to reclaim the public lands; appropriating for this purpose receipts from the sale and disposal of the public lands in the 16 states and territories of the arid regions.

Irrigation developments in the Big Horn Basin began in the 1880's and was being carried on along many streams by 1890. Larger developments under the Carey Act began about 1900 and were continued to include nine such projects of which three are along the Big Horn River, one on Shell Creek, four on the Shoshone River and one on the Greybull River. Early Carey Act projects ranged in size from 4,000 to 20,000 acres and embraced a total of about 117,000 acres.

Construction of irrigation facilities on the Shoshone Project were undertaken by the Bureau of Reclamation in 1904 and water for the projects for irrigation was provided in 1908. Located near Powell and Cody, Wyoming, the project consists of five divisions, three of which are completed and settled. Buffalo Bill Dam creates Shoshone Reservoir, which regulates stream flow for project use in power production. Storage capacity of this reservoir is 456,000 acre feet. The first irrigation water on the project was delivered on the Garland Division in 1908. In 1917, the Frannie Division was first opened to settlers and the Willwood Division in 1927. The Heart Mountain Division is now being settled, with the first homestead units being occupied in 1946. The four divisions in operation are shown in Table No. 6.

Table No. 6.- Irrigated and irrigable areas of Shoshone Reclamation Project Divisions, 1950 1/

Division	Irrigated (acres)	Total Crop Values <u>2/</u> (dollars)	Additional Irrigable Land (acres)	Division Total (acres)
Garland	34,061	2,561,000	7,566	41,627
Frannie	11,736	521,000	8,305	20,041
Willwood	10,497	738,000	1,045	11,542
Heart Mountain	7,039	89,000	6,908	13,947
Project Total	63,333	3,909,000	23,824	87,157

1/ Compiled from Bureau of Reclamation records.

2/ For calendar year 1947.

The average elevation of the Shoshone Project is 4,500 feet above sea level. Average precipitation is about six to eight inches per year, which makes farming entirely dependent upon irrigation. Soils on the project areas vary from sandy to clay-loam and are underlaid in some places with coarse gravel and in others by sandstone and shale. The topography is reasonably smooth on most of the lands, although in some of the outlying portions it is rolling and more or less broken. The leading crops grown on irrigated lands in the area are beans, alfalfa, sugar beets, potatoes and grain, all of which yield well when properly cultivated and irrigated. Sugar beets are processed at a factory in Lovell,

Wyoming, which lies east of the project. Seed peas, seed beans and radish seed are grown under contract and delivered to warehouses in Powell, Wyoming. Alfalfa hay produced on the project is generally insufficient to supply local demand. Livestock feeding and production is an important and profitable part of the program on irrigated farms. Range land surrounding the project, the bulk of which is public domain, furnish pasture for thousands of sheep owned by stockmen, who purchase surplus feed or bring their lambs to the farms to be fattened for market. Dairying, hog and poultry production are also important facets of the irrigated economy.

The Garland and Frannie Divisions, north of Shoshone River, are served by the Garland Canal which diverts water from the river at Corbett Dam. The Willwood Division, on the south side of the river, is served by the Willwood Canal originating at the Willwood Dam. Irrigation deliveries started in 1943, on the Heart Mountain Division, which is north of the Shoshone River, between the Shoshone River and the Garland Division. It is supplied by means of a three mile tunnel under Cedar Mountain and a large pipeline across the river.

Extensions of the Shoshone Project contemplate the development of an additional 92,030 acres of irrigated lands, most important of which are the Oregon Basin, Buffalo Basin and Polecat Bench Units. Development on other Big Horn River tributaries embrace scattered areas, or narrow strips, in the stream valleys. The various units contemplated for development are shown in Table No. 7, Summary of principal reclamation developments proposed by the Bureau of Reclamation in the Big Horn Basin. In the category of possible irrigable areas not included in the table is the "Y-U Bench," a high terrace bordered by the Greybull River to the south and Oregon Basin to the north, containing an irrigable area of approximately 13,500 acres.

During past years severe water shortages have occurred on Greybull River and on Gooseberry, Cottonwood, Owl, Nowood and Shell Creeks. A primary need in many of these areas is for supplemental water for late season use. Considerable land previously irrigated has now been abandoned along some of these streams, especially along Owl Creek. This problem will be solved upon completion of the Anchor Dam in Owl Creek. Another proposed project of the Bureau of Reclamation is the Paintrock Unit on Paintrock Creek, a tributary of Nowood Creek. Initial development of this project will provide a supplemental water supply for approximately 4,500 acres of land now inadequately watered and will bring 2,400 acres of new land under irrigation along lower Nowood Creek. Similarly, plans of the Bureau of Reclamation provide for the construction of the Red Gulch Reservoir in Shell Creek, which will provide supplemental waters for approximately 6,600 acres of inadequately irrigated land in that valley.

Table 7.- Summary of Principal Reclamation Developments
Proposed by Bureau of Reclamation in Big Horn Basin, 1950 1/

Name of Unit	Purpose of Unit <u>2/</u>	Irrigation Area		Total Land Acres	Name of Reservoir
		New Land Acres	Supplemental Land Acres		
Big Horn Basin Division					
Beaver Flat	I	1,050		1,050	Boysen
Big Horn No. 2	I	1,860		1,860	"
Big Horn No. 3	I	1,380		1,380	"
Bluff	I	960		960	"
Greybull Flat	I	1,830		1,830	"
Hanover	I	5,310		5,310	"
Kane	I	2,410		2,410	"
Kirby No. 1	I	1,130		1,130	"
Kirby No. 2	I	630		630	"
Pease	I	2,200		2,200	"
Red Flat	I	900		900	"
Owl Creek	I, F		17,113	17,113	Anchor
Paintrock	I, F	2,360	4,570	6,930	Lake Solitude
Cody	P				Holden
Shell Creek	I, F		6,560	6,560	Red Gulch
Shoshone Project Extensions	I, F	92,030	3,425	95,455	Oregon Basin
Total Big Horn Division		114,050	31,668	145,718	
Clark's Fork Division					
Bald Ridge	P				Bald Ridge
Hunter Mountain	P, I, F				Hunter Mountain
Thief Creek	P, I, F				Thief Creek
Sunlight	P, F				Sunlight
Total Clark's Fork Division					

1/ Data obtained from report prepared by Bureau of Reclamation, Branch of Project Planning, "Report on Sufficiency of Water Supply to Meet All Requirements of Presently Conceived Plans of Development in the Missouri River Basin, January 1950 (Revised May 1950)."

2/ I - Irrigation

F - Flood Control

P - Power Development

The proposed reclamation development on the main stream of the Big Horn River depends entirely on pumping from the river. These units are planned to include all areas of suitable land for which water can be economically provided by pumping facilities. Eleven separate irrigation pumping units are proposed which will provide for the development of approximately 1,700 acres of new land, according to recent Bureau of Reclamation estimates. The units vary in size from 620 to 5,310 acres and will require pump lifts of 15 to 150 feet. Because of the power necessary for lifting this water, there will undoubtedly be some delay before all of the pumping projects will be completed. Water storage for these projects will be supplied by the Boysen Reservoir.

Seasonal water shortages on lands irrigated from main stream projects were analysed by comparing stream flow records at Thermopolis with estimated daily irrigation requirements for the 4,800 acres irrigated in 1940. The lowest run-off during the period 1931 to 1940, inclusive, occurred in 1934. As a result of this analysis the Bureau of Reclamation concluded that under existing conditions our water storage in the Boysen Reservoir will adequately provide for proposed developments as well as for supplemental supplies on lands now irrigated from the main stream.

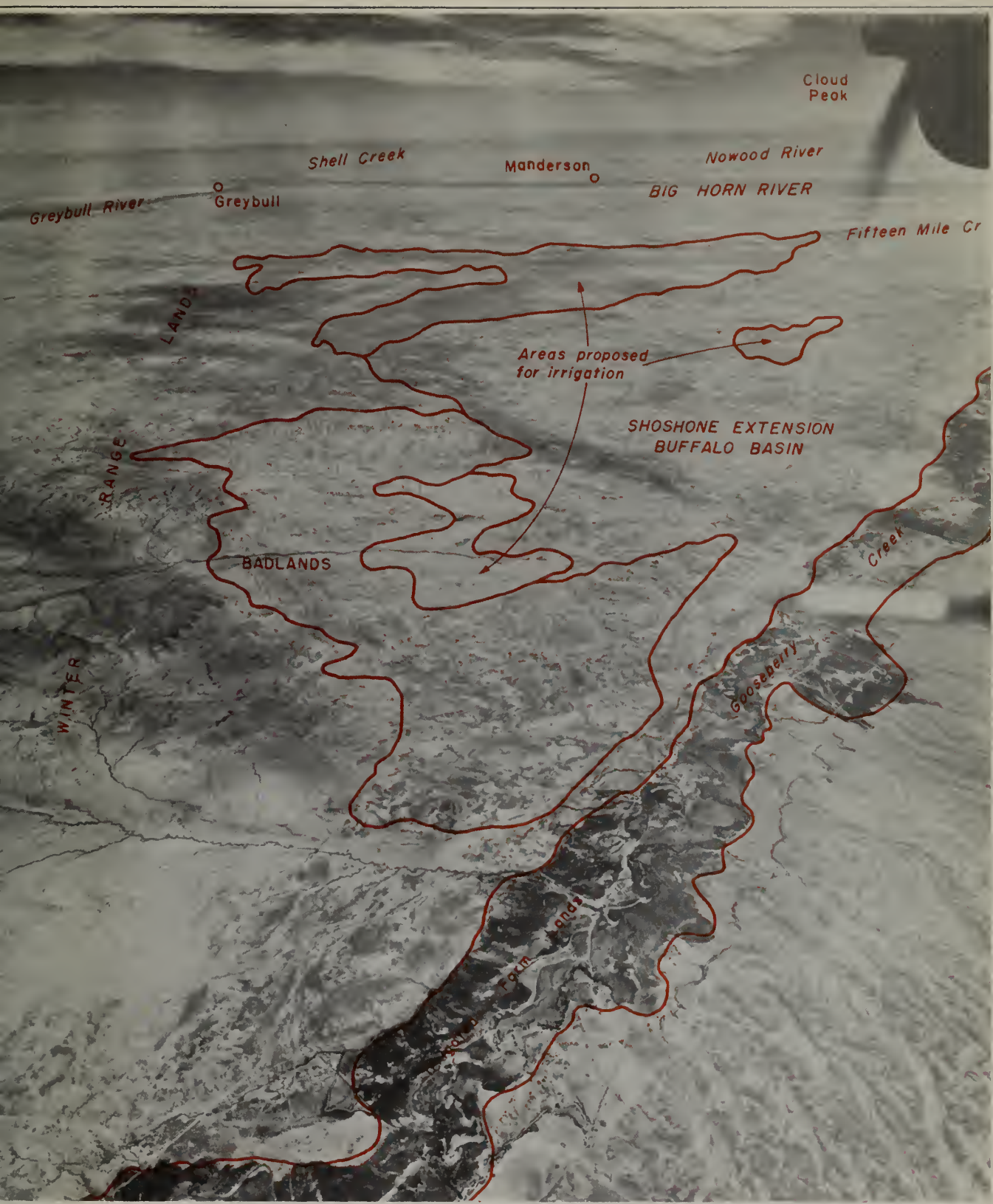
In the plans for reclamation development in the Big Horn Basin, four reservoirs are planned with an aggregate capacity of 195,000 acre feet as shown in Table 8.

Table 8.- Proposed irrigation storage reservoirs in the Big Horn River Basin, Wyoming, 1950 1/

Name of Reservoir	Storage Capacity (acre feet)	Units Served
Big Horn Basin Division		
Oregon Basin	150,000	Shoshone Project Extensions
Anchor	22,000	Owl Creek
Lake Solitude	8,000	Paintrock
Red Gulch	15,000	Shell Creek
Boysen	1,493,000	Big Horn Pumping <u>2/</u>
Clark's Fork Division		
Hunter Mountain	150,000	<u>2/</u>
Thief Creek	130,000	<u>2/</u>

1/ Data obtained from report prepared by Bureau of Reclamation, Branch of Project Planning, "Sufficiency of Water Supply to Meet All Requirements of Presently Conceived Plans of Development in Missouri River Basin, January 1950, Revised May 1950."

2/ Boysen will also serve units outside of report area.



General view of south central Big Horn Basin proper looking northeast from a point about 15 miles southeast of Meeteetsee, Wyoming.

Boysen Dam, now under construction in Wind River Canyon above the Big Horn Basin, will have a total storage capacity of 1,493,000 acre feet. The prime function of the Boysen Dam and Reservoir is to regulate the flow of the Big Horn River. The unit is the cornerstone upon which future developments in the Big Horn Basin can be based. It will provide electrical energy desperately needed in the Big Horn Basin and will allow irrigation developments, both upstream and downstream, that are not now possible. Incidental benefits will include de-siltation of the Big Horn River, flood control and recreational benefits. The 560,000 acre feet of reservoir capacity that has been set aside for irrigation and power development will not only provide a farm irrigation supply for new downstream irrigation, but will protect existing downstream irrigation water rights, so that additional upstream diversions may be made. Also it will allow releases to be made for power generation. Approximately 260,000 acre feet of reservoir capacity has been reserved for silt deposition and 673,000 acre feet of super-storage has been provided for flood control. Power supply from the Boysen Dam will be interconnected with the Bureau of Reclamation generating system at Buffalo Bill Dam, to the north and the Seminole Dam on the North Platte River, to the southeast.

The proposed Yellowtail Reservoir, to be located at the mouth of the Big Horn Canyon in Montana, will create a lake containing a storage capacity of 1,375,000 acre feet. The installation will regulate the flow of the river and will provide water for irrigation developments below; it will allow for the generation of power and will provide for flood control and sedimentation features. According to records of the U. S. Geological Survey, the average annual discharge of the Big Horn River at Yellowtail Dam Site during the years 1931-1940, was estimated to be 2,137,000 acre feet, with a maximum monthly flow of 646,000 acre feet and a minimum of 68,000 acre feet.

Additional reclamation developments under consideration by the Bureau of Reclamation in the Clark Fork of the Yellowstone drainage area, include the construction of four reservoirs in the Wyoming portion of that basin, with a contemplated total storage capacity of 325,000 acre feet. The principal purposes of the Hunter Mountain and Thief Creek Reservoirs are for power generation, irrigation development and flood control. Sunlight Reservoir will provide for power generation and flood control, and Bald Ridge will provide for additional power facilities. These water developments will not provide for additional irrigation within the area described in this report.

A total of 346,521 acres of public domain lands have been withdrawn for reclamation purposes, under first form withdrawal authorized by the Reclamation Act of June 17, 1902. They consist of lands needed for irrigation works of various types, or for the protection of reservoirs,

or of areas withdrawn for investigation of the feasibility of new irrigation projects.

Pending the construction of irrigation works and the provision of water for irrigation, public lands included in reclamation withdrawals in most instances are available to the public for lease for grazing and agricultural purposes. The Bureau of Reclamation enters into leasing arrangements to a limited extent, but wherever practicable the administration of the grazing resources is handled by the Bureau of Land Management under cooperative agreement. Table 9, "Lands within and outside of grazing districts in the Big Horn Basin withdrawn for reclamation purposes, 1950," describes the extent and location of such withdrawn lands and types of administration imposed upon such lands. Classification of these withdrawn lands, (as well as other vacant, unappropriated lands proposed for withdrawal) to determine their ability to produce crops under a system of irrigation farming, is now under way in the Big Horn Basin.

After these lands have been classified as suitable for irrigation and when irrigation works have been constructed and water is made available for irrigation, the withdrawn lands within reclamation projects are subject to entry under homestead laws in tracts not exceeding 160 acres. The Bureau of Reclamation administers these public land openings through local examining boards, who review the qualifications or prospective entrymen. When the number of qualified homestead applicants exceed the number of available farm units a drawing is held to decide on the ones to be allowed to enter the lands under the homestead laws. The public is informed of land openings by public notices issued by the Secretary, which indicate size of the farm unit and the total irrigable lands of the respective units.

Costs of construction and operation of Federal reclamation projects are reimbursed to the Federal Government by the water users. After settlement of the project, residual lands, which are temporarily or permanently unproductive are sold at either private or public sale to such resident owners and entrymen who qualify, at prices not less than those fixed by the independent appraisal approved by the Secretary. Cooperation is maintained by the Bureau of Land Management as to the disposal of small tracts of public land often lying within the boundaries of the project, but not coming within the authority of the various acts governing the sale of reclamation lands. In such cases the withdrawals are vacated and the tracts become subject to disposition under applicable public land laws of the United States.

Table 9.- Lands, within and outside grazing districts in the Big Horn Basin, withdrawn for reclamation purposes, 1950, (acres)

Administering Agency	Wyoming			Montana		Total
	Park County	Big Horn County	Hot Springs County	Carbon County		
Bureau of Reclamation	51,965	30,753		560		83,278
Bureau of Land Management <u>1</u> /	4,501	41,322				45,832
Bureau of Land Management <u>2</u> /	27,008	35,838	549			63,395
Total within grazing district	83,474	107,913	549	560		192,496
Bureau of Reclamation	77,989					77,989
Bureau of Land Management	76,036					76,036
Total outside of grazing district	154,025					154,025
Grand Total	237,499	107,913	549	560		346,521

1/ Lands withdrawn prior to 1935, administered by the Bureau of Land Management under cooperative agreement with the Bureau of Reclamation. Grazing fees are transferred to the Bureau of Reclamation.

2/ Lands withdrawn subsequent to the establishment of grazing districts where management remains with the Bureau of Land Management until such time as the land is needed for construction or development by the Bureau of Reclamation. The grazing fees are retained by the Bureau of Land Management. Licenses or permits are subject to cancellation at the end of the current grazing season. Reclamation withdrawals include 3,693 acres also withdrawn for stock-driveway purposes and 1,074 acres for power site purposes.

Bureau of Indian Affairs

Parts of two Indian Reservations, the Wind River Reservation in Wyoming and the Crow Reservation in Montana, are included within the Big Horn watershed. These Indian lands are for the most part under tribal ownership. The Wind River Reservation is located in Fremont and Hot Springs Counties, Wyoming and totals 225,160 acres, approximately 21,440 acres of which are patented lands within the exterior boundaries of the reservation. Approximately 251,000 acres of the Crow Indian Reservation, that part of the basin located in Big Horn County, Montana tributary to the proposed Yellowtail Reservoir, are within the report area. Part of the Crow Reservation, south of Devil's Canyon in Montana near the Wyoming line, is administered by the Bureau of Land Management under exchange-of-use agreement for public domain lands lying north of Devil's Canyon in Wyoming Grazing District No. 1. In this area Devil's Canyon forms a barrier to livestock movement.

U. S. Forest Service (Department of Agriculture)

Parts of three National Forests are located in the Big Horn Basin; the Shoshone and Big Horn in Wyoming and the Custer in Montana. The Shoshone National Forest is located in Hot Springs and Park Counties, Wyoming and comprises a net area of 1,390,000 acres. The Big Horn National Forest is located in Big Horn, Johnson and Washakie Counties, Wyoming and comprises a net area of approximately 410,000 acres. The Custer National Forest consists of two divisions, the Pryor Mountain and Beartooth Divisions, located in Carbon and Park Counties, Montana and totals a net area of 226,000 acres. The total net area of National Forest lands in the report area is 2,026,804 acres. Also included within the exterior boundaries of the National Forests are approximately 27,400 acres of private lands. Some state lands still remain within the exterior boundaries of the National Forests, but are comparatively negligible in extent.

National Park Service

The Shoshone Cavern National Monument, containing 208 acres, is located in Park County, Wyoming and is administered by the National Park Service. No development has been made of this area.

State Lands (Wyoming)

There is a total of 407,000 acres of state lands in the area. These lands consist primarily of state school lands or indemnity selections, granted to the State of Wyoming by various enabling Acts for the support of common schools. They are mostly suited for grazing and are leased to livestock operators owning or operating adjoining lands. Approximately 640 acres of state lands are encompassed within the Hot Springs State Park at Thermopolis, Wyoming.

State Lands (Montana)

Within the area there is a total of 27,925 acres of state land located in Carbon County, Montana. Virtually all of these lands are situated within the Montana Grazing District No. 4 and are leased to livestock operators for grazing purposes.

Railroad Lands (Northern Pacific)

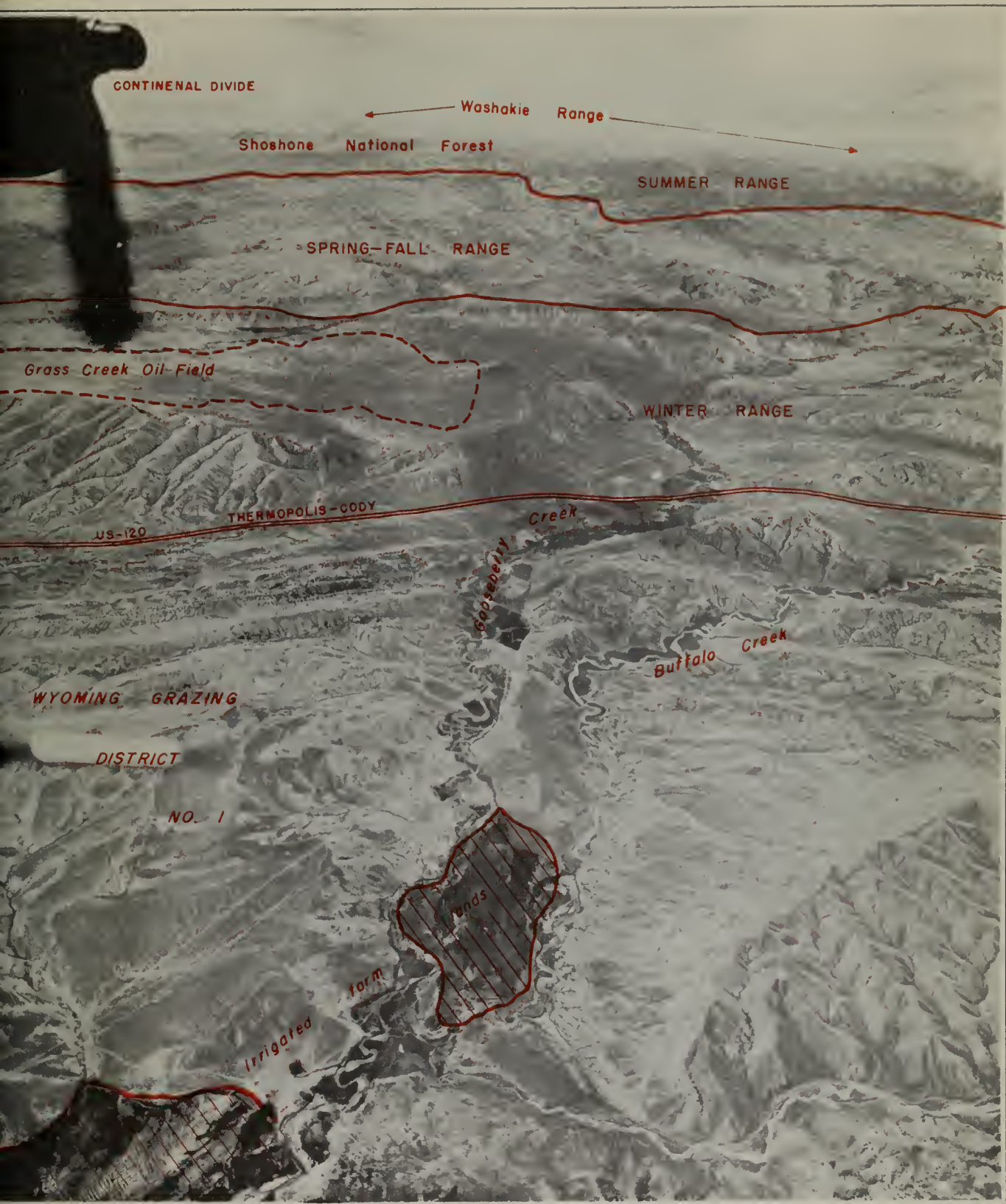
Approximately 16,100 acres of railroad lands are located in Park County, Wyoming. These lands are remnants of large checkerboarded areas where alternate sections were granted by the Federal Government to the Northern Pacific Railroad to encourage the construction of railroads through the west. The bulk of such lands has been sold to private individuals.

Soil Conservation Districts

Within the basin are 11 Soil Conservation Districts, covering a total of approximately 7,500,000 acres. These districts are locally organized, locally administered units organized under authority of state law expressly to enable farmers and ranchers to work together to conserve soil and water resources. They provide the means for landowners to analyze the local conservation problems, develop a program for their solution and secure the help needed to carry out the program. Soil Conservation District programs are based on the capabilities of the land and are aimed at the development and the application of complete conservation plans for private lands on the farms and ranches. These conservation plans include specific combinations of conservation practices where needed for each piece of land. Through such districts the farmer or rancher is provided with the services of men technically trained in soil and water conservation, to help them determine the use for which each acre is suited and the treatment it needs. Many of the users of Federal range land cooperate with the Soil Conservation Districts. The state law under which these districts operate provides for cooperation with all Federal agencies concerned with the conservation of soil and water. Field agreements are in force between all the Soil Conservation Districts and the Bureau of Land Management within the Big Horn Basin.

Production and Marketing Administration

The Production and Marketing Administration of the Department of Agriculture, is organized on a state and county basis throughout the entire basin to assist farmers and ranchers to maintain and improve the soil and water resources on private and state lands and in certain instances upon the lands which are partly or temporarily owned by the Federal Government. The agricultural conservation program is administered



General view of southwestern portion of Big Horn Basin looking southwest from a point about 10 miles southeast of Meeteetsee, Wyoming.

by locally elected farmers and ranchers. Payments are made by the Federal Government to cooperators for carrying out approved soil and water conservation practices. While this program is not directly applicable to public domain lands administered by the Bureau of Land Management, it provides an excellent opportunity for coordination of conservation activities carried on by private landowners and administration of intermingled and adjacent public lands.

PROBLEMS AS RELATE TO PUBLIC LAND ADMINISTERED
BY THE BUREAU OF LAND MANAGEMENT

The report thus far has dealt, in a general way, with the lands of the Big Horn Basin; their location, description, character, and the uses which have been and are being made of them. The discussion has been with special reference to the unreserved public domain and the withdrawn lands for which the administrative authority lies with the Bureau of Land Management. Such lands comprise a total of slightly more than three and one-half million acres or 40 per cent of the entire report area. The preliminary reconnaissance survey of these lands and a cursory analysis of published reports and public records has revealed many problems relating to the management, protection, development and utilization of the public domain and its resources. As previously stated, the purpose of this preliminary survey and report is to determine and describe in general terms the role of the public lands in the development program and to point up the principal problems confronting the Bureau of Land Management in providing for the maximum contribution and service of these public lands to the comprehensive program for the development and utilization of the resources in the Missouri River Basin. Further investigations will be necessary and no doubt additional problems to those listed below will be discovered in the more detailed studies. The following problems appear pertinent at this time:

Problem 1. Watershed Breakdown and Consequent Siltation of Stream Courses and Reservoirs.

The construction of Yellowtail Dam in Big Horn Canyon, in Montana, will greatly increase the watershed significance of the Big Horn Basin. Preliminary and partial analysis of silt studies for Big Horn River, now being carried on by the U. S. Geological Survey, indicate that both the concentration and volume of silt in the River increase progressively from Thermopolis and the upper portion of the drainage basin to Manderson and Kane in the middle and lower portion of the Big Horn Basin drainage area (see Table No. 10, page 72, and Table No. 11, page 73). Analysis of these studies for the water year ending September 30, 1948, shows that the average or mean daily sediment concentration at Thermopolis, Wyoming, for this period was 2,400 parts per million and the mean silt load, in tons per day, was 12,750 tons. Comparative figures for the Kane, Wyoming station, near the Montana line, show a mean daily sediment concentration of 4,100 parts per million and a mean silt load of 32,840 tons per day. While the survey studies thus far show a wide daily variation in stream flow and in silt concentration, the heaviest concentration and total silt load generally occur during periods of floods. During the period of record, the maximum daily silt load at Thermopolis was 250,000 tons on June 23, 1948; on the following day at Kane station it was 470,000 tons.

The Geological Survey studies indicate a condition similar to that found by the Corps of Engineers in silt studies made of the Big Horn River during the period 1938 to 1944. The Corps of Engineers studies showed the average annual silt load at Thermopolis to be 8,600 acre feet and at St. Xavier, Montana, 16,700 acre feet. A difference of 8,100 acre feet of silt accumulated by the river between Thermopolis and St. Xavier would be the approximate silt load picked up in the drainage area of Yellowtail Reservoir, St. Xavier being located only a few miles below Yellowtail Dam Site. Silt flow at Thermopolis will soon be greatly reduced when Boysen Dam is completed.

Much of the silt carried by the Big Horn River and its tributaries originates during flood periods, although silt movement is a constant and continuing process. Floods in the Big Horn Basin are seldom of a general nature, but are usually local, covering a relatively small area. Occasionally, however, they are more general in nature involving the entire watershed and are caused by either fast-melting snows or heavy rains. Recurring floods, which are too often but a manifestation of improper land-use, destroy field crops and bottom land irrigation enterprises, railroads and highways for transportation, canals and pipelines for water supplies, oil and gas pipelines and installations, public and industrial developments, homes and other installations. In most places where land is put to these uses, alternate sites are not feasible and recurrent floods repeat the damage to rebuilt structures.

Floods in the Big Horn Basin may be classified into three general groups: (1) an early spring rise, usually in March, caused by melting of snow in the valley and frequently augmented by ice-jams; (2) a June flood, resulting from melting of mountain snow, plus a possible contribution by rainfall; (3) a late summer flood, generally from heavy rains, examples of which are those of July and September, 1923.

Although the main stream may not be at heavy flood stage, it is nearly a certainty that one or more of its tributaries will reach flood stage during each summer.

Two of the most damaging floods of record for the Big Horn River, occurred as a result of a series of heavy rains from July 22 to 26, 1923, and from September 27 to 29, 1923. The July flood caused more damage in the upper or Wind River drainage above Boysen Reservoir, but much damage was done in Big Horn Basin, including the flooding of the town of Thermopolis and the washing-out of the railway bridge over Red Canyon Creek above Thermopolis. Canals which divert water from the Big Horn River for irrigation of a large acreage of farm lands were severely damaged and several thousand barrels of oil were lost through a damaged oil pipeline. During the September flood the towns of Thermopolis,

Manderson, Basin and Greybull, were all flooded resulting in considerable damage at each place. The July flood was caused by heavy rains of near cloudburst intensity over a comparatively small area and the September flood was caused by a general rain of less intensity, but longer duration, over the entire drainage basin.

In addition to tangible flood damages to physical properties resulting from floods similar to those above described, there are also countless less spectacular damages to range and farm lands through soil erosion. In addition to erosion caused directly by floods there is also widespread sheet erosion, usually on soils poorly protected by vegetative growth and organic mulch. Although less spectacular to the average observer than some other types of erosion, sheet erosion is one of the most serious and far-reaching erosion problems. This insidious type of erosion reduces the soil's fertility and impairs its productive capacity. It is a problem over which man can exert an important corrective influence through proper land management practices and rehabilitation measures.



Roadside "Gulying" as a result of improper handling of runoff water from drainage crossing highways. This is in Wyoming Grazing District no. 1 on the main highway between Greybull and Lovell

Other types of water erosion are observed in streambank cutting, channeling and the rapid extension of gully networks in many areas throughout the basin. This type of erosion results not only in the loss of soils and any vegetative cover present, but also in a rapid runoff and a lowering of the water table, which in turn causes further deterioration of the vegetation and soils, because of surface and ground water losses.

Wind erosion is significant throughout the basin, and is especially serious during dry seasons. Greatest damage is caused to crop lands unprotected by crop growth, stubble, or rough tillage; and to range lands having a sparse natural covering of vegetation and loose, undeveloped surface soils.

Soil and moisture losses through erosion processes are often unwittingly caused by carelessness and lack of foresight. Lack of proper drainage and erosion control facilities along highways, roads, trails, reservoir spillways and irrigation developments are common examples of such losses. On farm lands in the basin all of which require irrigation for crop production, soil losses are caused by poor tillage methods, improper irrigation practices, improper disposition of waste water and the improper use of some land for cultivated row-crops, which instead should be utilized for permanent pastures. Other examples are vegetation, soil, moisture and watershed losses which are brought about each year by man-caused fires on range and timber lands.

The importance of the problem of watershed impairment and sedimentation is recognized by the Bureau of Land Management as it relates to the lands under its supervision. The problem is not, however, peculiar to the public domain only, but unquestionably is more critical there than elsewhere due to their poorer soil, vegetative cover and topographic characteristics. Generally, the public domain occupies lands of lowest productivity with respect to surficial resources and is thus inherently the greatest contributor per unit area to siltation and sedimentation of downstream waterways from geologic erosion. Many years of unregulated use prior to 1935 have no doubt contributed to the deterioration and depletion of the vegetative cover which in turn has resulted in the acceleration of the erosional processes. Surface shales, immature soils and steep slopes are typical of vast areas in the basin, most of which are administered by the Bureau of Land Management. Although the relative amount of silt from each class of lands is yet undetermined, it is logical to assume that these badlands contribute more than their proportional share to the sediment load to the Big Horn River. Accordingly, the problem of first priority of the Bureau of Land Management is one of proper watershed management, development and protection for the most effective control of erosion and consequent siltation and sedimentation.

The solution of the silt problem is dependent upon two physical accomplishments. First, wherever possible, soil must be held in place. The maintenance of an adequate vegetative cover is the only practicable means by which this can be accomplished over extensive areas. Second, where topography, soils, geology, climate and other natural conditions preclude the maintenance of an adequate vegetative cover, and where normal and geological erosion results in any considerable silt movement, the resulting silt must be trapped if reasonably possible before it reaches the main channels.

The areas described below and shown on the map entitled, "Proposed Study Areas," page 74, possess the most critical erosion and siltation problems and will require further detailed investigations and study:

(a) Fifteen Mile Creek drainage

This is a relatively large body of low-lying, rolling to rough lands draining generally eastward. The main creek adjoins Big Horn River near Worland, Wyoming. The surface is broken by areas of "badland" type formations. Sparse vegetation and unstable soils, together with some over-use during winter and spring grazing periods has resulted in extensive erosion and heavy sediment contribution to the Big Horn River. Trespass horses are also causing damage by excessive grazing use.

Other similar, but less extensive, drainages in this general locality include Five Mile, Ten Mile, Elk and Dorsey Creeks. These tributaries and the smaller north-sloping tributaries of the Greybull River all lie immediately north of the Fifteen Mile Creek area and have similar erosion problems to those found on Fifteen Mile Creek.

(b) Nowood River-No Water Creek drainage

The drainage area of the Nowood River and No Water Creek, contains extensive areas or badlands, in which normal geological erosion is high and runoff is heavily charged with sediment. The outer margins of this area are mountains and foothills which extend to elevations of 7,500 feet above sea level. Outside of the timbered areas the vegetative cover consists of grass and sagebrush types, which is used ordinarily for spring, fall and summer grazing. The critical shortage of spring range for livestock use throughout the basin creates a high demand for range land in this area. Eradication of dense stands of big sagebrush and replacement by valuable forage grasses appears to be a desirable improvement for the upper reaches of this area.



Badland formation west of Worland, Wyoming composed of Cody shales. Climatic and geologic conditions have prevented soil formation and plant growth and the "fixing" of the land surface. Runoff and erosion rates are high from such areas



Typical badland area between Worland and Tensleep in Wyoming Grazing District no. 1. Such areas are extensive in Big Horn Basin and are used for winter grazing. Normal geologic erosion is high and runoff from such areas is heavily charged with sediment

Salt-sage and sagebrush dominate the lower basin areas and are used primarily for winter grazing by sheep and cattle. Considerable acreages are withdrawn for stock-driveway purposes and erosion problems are similar to those found in Fifteen Mile Creek drainage.

(c) Kirby Creek drainage

Erosion conditions within this area are very critical. Gully erosion is very severe particularly on the lower portion of this watershed. Gullying and bankcutting grow progressively more evident in the lower portions of the area, where vegetation is sparse and runoff waters attain greater velocities. Salt-sage, sagebrush and grass make up the principal vegetation. Besides erosion control the principal needs for this area appear to be additional livestock watering places, fencing for distribution of livestock, sagebrush eradication and grass reseeding.

(d) Owl Creek-Gooseberry Creek drainage

Erosion conditions within parts of this area are considered critical. Gully erosion is critical in nearly every section and gains importance in the lower portions of the area where vegetation is sparse and runoff waters gain greater velocities. Vegetative cover in the lower basin is predominantly sagebrush, salt-sage and grass. In the upper portion of the drainage there are scattered stands of timber. The movement of water and silt must be controlled by increasing and improving the vegetative cover and the construction of impounding and detention structures, both from the tributaries and the main drainage ways. Range-use facilitating projects such as fences and stock-water reservoirs appear to be needed throughout the area in order to obtain proper distribution and control of livestock.

(e) Upper Greybull River area

All of the public domain within this study area is located outside of Wyoming Grazing District No. 1 and in southern Park County adjoining Shoshone National Forest on the west. In comparison to other areas the erosion problem is not large, except for one small area: the discharge system of Sunshine Reservoir. This irrigation development was constructed without adequate discharge structures, with the result that Sunshine Creek below the dam is continually changing its channel and gouging out a continuous load of silt that is being carried down through the Greybull River to the Big Horn River.

(f) Oregon Basin-Dry Creek area

In this area all types of erosion exist in varying degrees. Large areas are withdrawn for reclamation purposes. Destructive erosion taking place on public range lands must be controlled to

prevent silt and flood water damages to downstream structures and irrigation developments. Relatively large areas appear suited for conservation treatment such as water-spreading, contouring and range reseeding in order to adequately protect the soil, reduce runoff and siltation and promote maximum forage production. The erosion problem, however, is complicated by the fact that a considerable area is withdrawn for reclamation purposes. It is extremely important that the Soil and Moisture Conservation Program of the Bureau of Land Management and that of the Bureau of Reclamation be more effectively coordinated in order to provide for the needed conservation practices on the lands withdrawn for future reclamation development.

(g) Shell-Kane area

The topography on much of this area is extremely rough and broken and contains a high percentage of "badlands". Erosion conditions over the area are critical due to a combination of past heavy use, poor soil condition and topography. Severe sheet erosion exists in local areas, while gully erosion is evident in varying degrees in all parts of the area. The lower areas are utilized during the winter months by both sheep and cattle, while areas adjacent to the higher elevation forest lands are mainly spring, fall and summer range.

(h) Shoshone-Elk Basin area

Much of this area is occupied by the Shoshone Irrigation Project, while considerable areas are withdrawn for future reclamation development. Erosion conditions are critical in localized areas and because of their proximity to high-valued irrigated lands, conservation treatment of the public domain is highly desirable. Additional range-use facilitating projects will help to alleviate the erosion problems.

(i) Bridger area, Montana

Including all of the public domain in the Montana portion of the report area, this area is similar to the adjoining Shoshone-Elk Basin Area, in condition and needs.

Problem 2. Land-Use Adjustments

As most of the land in the basin is range land, range management has a most important bearing on the economy of the area. Some of the most important factors to be considered are:

(a) Is the range being grazed during the proper season?

Early spring is the critical period for range plant growth. Too early use of the range during this period does not permit continued reproduction and perpetuation of the more desirable range plants.

(b) Are the range resources being over-used?

Rate of stocking should be based on range inventory and condition survey.

(c) Is proper distribution of grazing use being accomplished?

If not, what additional range-use facilitating projects are needed?

(d) Is adequate supervision being given to eliminate trespass?

(e) What critical areas need extra protection to permit rehabilitation?

(f) Is proper integration of range and crop land use being achieved?

Integration of feed production and consumption on farm and range lands will result in an improved economy for both livestock and farm land operators. In areas where there is insufficient spring-fall range it may be possible for operators to develop irrigated and mixed pastures and crested wheat pastures for spring-fall use. Development and use of pastures would increase the economic returns of the operators from their enterprise and would also bring about range improvements and reduce erosion. The development of newly-irrigated areas will call for disposal of additional forage crops and grains by feeding to livestock. Range livestock in adequate numbers thus becomes of importance. In turn availability to livestock of adequate areas of public range lands for varying periods of seasonal use will also be of critical importance to the development of the overall basin area economy.

(g) The acquisition and use of private lands for reservoir purposes, which now form base properties to support public land grazing privileges, will require studies in each case to determine alternate land-use and livestock operation adjustments.

(h) The enlargement of irrigated farm land acreage will make available an increase in feed supplies in the Big Horn Basin. This increased supply of feed may call for changes in operations of ranchers near reclamation projects. It may cause a larger shift to cattle

operation, as cattle are better adapted to feeding operations than sheep. It will undoubtedly cause a shift to a greater amount of feeding and fattening of livestock, locally. Detailed studies will be required to determine the probable influence of these reclamation programs and the increased crop production on the livestock industry and the local economy of the basin, particularly as it relates to the use of public range lands.

(1) The increased supplemental feed production expected as the result of the greater amount of irrigation may bring about a substantial increase in public range demand in an attempt to balance the operations with lower price range feed; also any improvement in range administration which may result in a lower rate of stocking for existing ranges will increase the unsatisfied demands for range feed. It is quite probable, therefore, the public range demand will be substantially greater with the completion of the proposed extension of the irrigation program than it now is. In a similar manner an imbalance in some range areas between wildlife use and domestic livestock use of the public range lands will exist after new irrigation projects are initiated. The details of this probable imbalance are not now known, but should be considered in a comprehensive plan for the development and use of public domain resources.

Problem 3. Multiple and Conflicting Uses of the Public Land

The question of proper land-use may have different meanings for different people. For example, a given area of public domain may be classified by stockmen as range or grazing land, by sportsmen as a recreational area, by a forester as timber land or by a hydrologist as watershed land. Each of the four men may be correct in his judgment concerning the best use for the area, based on the education, training and interest of the respective individual. It is possible, however, that each may be only partially right and instead of being valuable for only one use, the area may be classed by a fifth man as having its highest value in a combination of all four uses under a properly balanced and integrated land management program. In the latter case the land would yield four separate crops--feed for livestock, game or other recreational facilities for the sportsman; wood, poles, posts or lumber for the forester; and water for the hydrologist. If properly managed on a sustained yield basis, the lands could continue to produce these four crops indefinitely. Most of the public lands are suitable for more than a single use. Where multiple uses do not conflict, it is the policy of the Bureau of Land Management to encourage as many uses of the public lands as appear consistent with the optimum use--the most important use to the general public. Detailed investigations should carefully consider the multiple-use aspects of public land areas.

Problem 4. Land Tenure

The land pattern of the Big Horn Basin is less complicated than that of many other Missouri Basin areas. The accompanying map depicts land ownership classes in color. The public lands for the most part are in fairly large bodies except along the foothills near the base of the mountains, where there are frequently small isolated tracts. Despite the fairly large percentage of public lands generally located in large blocks there are several land ownership problems in the basin which make administration and proper land-use difficult. These problems are listed as follows:

(a) A study of the land pattern outside of the grazing district should supply information for determination of whether certain areas not now in grazing districts could be better administered and controlled in a grazing district. One of the best examples of a large block of public lands outside of the grazing district is that area north of the Greybull River and southeast of Cody, extending eastward to the east side of Range 98 west, including Oregon Basin and Dry Creek drainage.

(b) In certain portions of the basin, generally in the foothill areas, both within and outside of the grazing district, there are small isolated areas of public lands which may not have any special public value. It is possible that some of these small isolated tracts could be offered as trading stock to private individuals or the State of Wyoming in return for which certain privately-owned or state lands located within areas of predominately public domain ownership could be obtained. In this manner the land pattern might be improved by blocking or consolidating isolated tracts to the advantage of the Federal Government, individuals and the state.

(c) For certain isolated public lands, a study may reveal that the sale provisions of the Taylor Grazing Act could be applied advantageously when the lands are known to have no public values and when such areas are unlikely to be involved in an exchange program.

(d) There are numerous areas of lands withdrawn for stock-driveway purposes, especially in Park County, Wyoming, outside of the Wyoming Grazing District No. 1, which are apparently not needed or used for stock-driveway purposes. Livestock operations in the area have changed somewhat since these withdrawals were effected, particularly since improvements in trucking facilities have reduced the trailing of livestock to markets, shipping points and to seasonal ranges. In some areas reconnaissance studies indicate there is a vital need for some of the driveways to be retained for trailing purposes. In such areas there is also a need for improvements such as water developments, fences and resting places. In localized areas, driveway

continuity is a problem which will require adjustments in tenure through exchanges and additional withdrawals. To assure the orderly use and fullest development of the public stock-driveway and to determine what lands are no longer needed for this purpose, further studies should be made.

(e) The north-central and central part of the basin includes large acreages of lands withdrawn for proposed reclamation projects. Grazing use of some of the withdrawn lands not needed immediately for reclamation is supervised by the Bureau of Land Management under an agreement between the Bureau of Reclamation and the Bureau of Land Management, approved by the Department in 1945. The Bureau of Reclamation leases still other portions of the withdrawn lands directly to stockmen for grazing use while other portions are used for grazing without either a permit or lease from this Bureau or a lease from the Bureau of Reclamation. Such mixed procedures are confusing to range users and to the responsible land agencies involved. It is also conducive to trespass and improper land-use and complicates the enforcement problem. Studies and cooperative arrangements by the two agencies involved should provide sufficient data for a uniform type of administration of the withdrawn lands until such time as it is definitely known which lands will be used for reclamation. A joint study is necessary to determine actual needs for such areas for reclamation purposes. Withdrawn areas in excess to these needs should be restored to public domain status.

(f) Certain areas of key privately owned and state lands having special public values should be in a plan for acquisition by the Federal Government if they would facilitate the public land management program. Examples might include lands having special value for fire control, watershed protection or for stock-driveway purposes. Detailed studies will determine the specific areas which should be included in the land acquisition program.

(g) A study should be made to determine whether any forested public domain lands adjoining National Forests could better be managed as a part of the National Forest than as public domain.

(h) Mineral examinations are necessary to clear public land titles, to permit proper public land-use and to provide for orderly and lawful exploitation of the mineral resources on the public domain and at the same time to prevent illegal use of the public lands under the guise of claims which are invalid. While an inventory of mineral resources is not the responsibility of the Bureau of Land Management, detailed classification studies will reveal the mineral resources of the public domain and will be carried out in close cooperation with the U. S. Geological Survey and other agencies interested in such resources.

(i) There are 40 areas within the Big Horn Basin, delineated as oil and gas geologic structures. The administration of lands within these known geologic structures is accomplished jointly by the Bureau of Land Management and the U. S. Geological Survey. Grazing use of the public domain is administered by the Bureau of Land Management, which, while seldom conflicting, may at times be incompatible with the fullest development of the public domain resources.

(j) Increased demands for recreational purposes will undoubtedly develop as the full reclamation development program gets under way. This will necessitate the integration of multiple uses on adjoining public domain, which may become riparian to proposed reservoirs. Detailed examinations of the public lands will reveal their potential contribution to the recreation needs of the area.

Problem 5. Other or Related Problems

(a) During the course of reconnaissance field surveys discovery was made of an invading poisonous plant, *Halogeton glomeratus*, in the vicinity of Powell, Wyoming, and studies indicate the area of infestation is rapidly increasing. The plant, native to Russia, is a prolific annual; the seeds of which are wind-borne. It is notoriously dangerous in that only a small amount of the plant will kill a sheep. Further studies should be made to determine the extent of the infestation of this plant, as well as other poisonous plants known to be found in the Big Horn Basin.

(b) Livestock losses in the Big Horn Basin from various causes are not unusually high for a range area. They are sufficiently high, however, to warrant taking all practical steps to reduce the losses to a minimum. The principal causes of livestock losses are winter and spring snowstorms and blizzards, which cause heavy losses especially of ewes and lambs. Other death loss is due to predatory animals, diseases, and poisonous plants previously mentioned. Overgrazing of ranges and undernourishment of range animals are indirect causes of both livestock and game losses, since animals in a weakened condition are easily susceptible to storms, predators and disease. When animals are undernourished and ranges are over-stocked, poisonous plants are consumed more readily than when an abundant variety of feed is available. Most range livestock hazard can be reduced materially by improved management of both livestock and range lands. Detailed studies are necessary to determine the location, type and method of improving utilization practices so as to improve the range and reduce soil and water losses as well as the reduction of livestock losses.

(c) In localized areas forage cover is reduced by prairie dogs and other rodents. The red-harvester ant is becoming a major problem in many parts of the basin. The activity of these vegetation-consuming insects seriously reduces the forage production and

consequently reduces the carrying capacity of the range. In some areas they are so numerous that the denudation of vegetative cover contributes heavily to erosion and rapid runoff. Experiments in control of these ants are now being carried out and when a feasible means of control or elimination has been discovered, it should become a part of the conservation program for public domain range lands.

(d) Detailed studies should be made of the problem of the control of forest and range fires on the public lands in the Big Horn Basin. Opportunities exist for initiating an effective educational program among ranchers, farmers and travelers in the area concerning the seriousness of range and timber fires and of means of fire suppression and control. Maximum fire risk on the public domain occurs during the summer months, especially in the foothills and plains immediately bordering the forested areas of higher elevations.

(e) A problem indirectly related to the problem of land tenure and public land control is that of the need for cadastral surveys for public domain areas where precise horizontal control is inadequate or entirely lacking. Detailed field studies will reveal the need for re-establishing and the remonumentation of public survey corners in public domain areas.

CONCLUSIONS AND RECOMMENDATIONS

Extensive reconnaissance surveys and preliminary analysis of various published and unpublished reports and records, upon which this report is based, have revealed many problems relating to the management, protection, development and utilization of the public domain and its resources. However, these studies do not prescribe detailed corrective measures since they have not been of sufficient detail to determine their scope and seriousness. Further investigations and detailed studies will therefore be necessary to develop a program which will provide for the maximum contribution and service of these public lands to the comprehensive Missouri River Basin Resource Development Program. Too often in the past, inadequate consideration has been given to the relationship of public land resources and their uses to water resources and other development projects.

Studies relating to the public domain should be carried out concurrently with other resource development investigations in order to obtain basic data from which to formulate a comprehensive public land development program and to assure orderly use and the most effective integration and coordination of the public domain resources and other resource programs. This will require that a qualitative and quantitative appraisal be made as to the effect, adverse or beneficial, the public domain resource and uses may have upon other management and development programs within or outside the basin.

Of the several major land-use problems pertaining to the public lands in the Big Horn Basin, watershed impairment and sedimentation is probably the largest single problem and should be given early consideration in any improvement or development program contemplated. Much of the silt in the Big Horn River is contributed by the public domain lands and has a direct effect upon programs for irrigation, hydro-power generation, fish and wildlife protection and propagation and the supplying of municipal, domestic and industrial water supply. It is evident, therefore, that unless erosion and sedimentation are controlled within practical limits upon the public domain lands, virtually all facets of the land-use economy of the Big Horn Basin will, in varying degrees, be impaired. Nor will the ill-effects of neglect in taking proper steps to control erosion and siltation be confined to the basin alone. The ill effects will be felt far downstream, since sediments deposited in downstream structures occupy valuable and costly water storage space. The utility, life and multiple uses of these downstream reservoirs and the downstream agricultural economy dependent thereon, will thus be jeopardized.

According to the Missouri River Basin studies being conducted by the U. S. Geological Survey ^{1/}, the sediment transported by the Big Horn River is derived mainly from its tributaries. Most of the tributaries, are actively downcutting and in many instances are eroding headward and laterally. According to the U. S. G. S. report, the drainage area between Thermopolis and Manderson, Wyoming, contributes not only the greatest quantity of sediment to the Big Horn River but also has the highest rate of erosion of the area in the entire Big Horn River drainage system. (See Tables 128 and 132, photostats).

It is of interest to note that, with the exception of Owl Creek which is a negligible silt contributing tributary, virtually all of these tributary drainages are located in their entirety within areas where public domain predominates. Measurements indicate that Fifteen Mile Creek probably contributes the largest sediment load to the Big Horn River of any of the tributaries. Sediment discharge measurements taken on May 29, 1948, for this tributary, indicated an instantaneous water discharge of 750 second feet, and an instantaneous discharge rate of suspended sediment of 243,000 tons per day. Ninety per cent of this critical watershed consists of public domain lands.

Cottonwood, Nowater, Kirby and Gooseberry Creeks, Sand Draw and other tributaries are similar offenders and the bulk of the lands in these drainage areas is public domain. Needless to say, these are but some of the "problem" areas.

While a high percentage of the public domain lands in the Big Horn Basin may be classified in the status of "problem" land, and while most of these lands need some type of corrective conservation treatment, the total amount or intensity may vary widely from one portion of the basin to another. Thus the total requirements for conservation may be several times greater in one area than in another of equal size, due to inherent physical land characteristics or land uses. Similarly, the type and urgency of treatments may vary widely. In fact, the acuteness of the erosion problem in some areas such as Fifteen Mile Creek does not permit a delay in initiating rehabilitation measures.

Footnote ^{1/} Progress Report Sedimentation and Chemical Quality of Water in the Big Horn River Drainage Basin, Wyoming and Montana, U. S. Department of the Interior, Geological Survey, Water Resources Division, Missouri Basin Studies 1950

Table 10. - Runoff and suspended sediment discharge, Big Horn River, Wyoming and Montana 1/

Station	Water year	Suspended sediment discharge				Water runoff in acre-feet	
		Period Tons	Period Cumulative		Period	Cumulative	
			Acre-feet				
Thermopolis, Wyo.	1946 (Apr.-Sept.)	3,388,000	2,590	2,590	702,350	702,350	
	1947	5,733,000	4,390	6,980	1,783,440	2,485,790	
	1948	4,668,000	3,570	10,550	1,185,250	3,671,040	
Manderson, Wyo.	1946 (Apr.-Sept.)	5,030,000	3,850	3,850	588,250	588,250	
	1947	10,320,000	7,900	11,750	1,759,540	2,347,790	
	1948	10,100,000	7,730	19,480	1,189,990	3,537,780	
Kane, Wyo.	1946 (Apr.-Sept.)	9,288,000	7,110	7,110	1,151,720	1,151,720	
	1947	15,780,000	12,080	19,190	2,551,420	3,703,140	
	1948	12,020,000	9,200	28,390	1,822,600	5,525,740	
Custer, Mont.	1948	14,050,000	10,750		3,284,500		

Volume in acre-feet = $\frac{\text{Tons} \times 2,000 \text{ pounds}}{60 \text{ pounds per cubic foot} \times 43,560 \text{ square feet per acre}}$

1/ Progress Report, Sedimentation and Chemical Quality of Water in the Big Horn River Drainage Basin, Wyoming and Montana. U. S. Department of the Interior, Geological Survey, Water Resources Division, Missouri Basin Studies, page 132, 1950.

Table 11.- Acre feet of suspended sediment per acre-foot of runoff and per square mile of watershed area, Big Horn River, Wyoming and Montana. ^{1/}
(Based on specific weight of 60 pounds per cubic foot)

Measuring station and reach	Drainage area (square miles)	Acre-feet of suspended sediment				
		Per acre-foot runoff			Per square mile	
		1946 Apr.-Sept.	1947 water year	1948 water year	Period of record	1946 Apr.-Sept. 1947 water year 1948 water year
Thermopolis	8,080	0.0037	0.0025	0.0030	0.0029	0.32 0.54 0.44
Manderson	11,900	.0065	.0045	.0065	.0055	.32 .66 .65
Kane	15,900	.0062	.0047	.0050	.0051	.45 .76 .57
Custer	23,000	- - -	- - -	.0033	.0033	- - - .47
Above Thermopolis	8,080	.0037	.0025	.0030	.0029	.32 .54 .44
Thermopolis-Kane	7,820	.010	.010	.0088	.0096	.58 .98 .72
Kane-Custer	7,100	- - -	- - -	.0011	.0011	- - - .22

^{1/} Progress Report, Sedimentation and Chemical Quality of Water in the Big Horn River Drainage Basin, Wyoming and Montana. U. S. Department of the Interior, Geological Survey, Water Resources Division, Missouri Basin Studies, page 128, 1950.

While the reconnaissance surveys and studies upon which the report is based have not been made in sufficient detail to permit recommendations for a comprehensive corrective action program it has been of sufficient intensity to lead to the decision that the entire public land area should be included in a program for detailed study. "Problem" areas have been sufficiently defined within the basin to determine the relative urgency of rehabilitation treatments and to the point where designation of the entire basin as a soil and moisture conservation project area would be in the public interest.

Land planning and classification studies of the public domain will be carried out on the basis of priority of need within problem areas and integrated with the action program of the Soil and Moisture Conservation Branch within the Bureau, as well as correlated with the programs of other agencies.

To permit orderly and early prosecution of an action program for specific problem areas, the report area has been delineated into nine major areas for further detailed studies and investigations. The name and location of each of these proposed study areas are shown on the map on page 74, entitled, "Proposed Study Areas and their relationship to Major Land Management Activities within Big Horn Basin." Each study area is briefly described as follows:

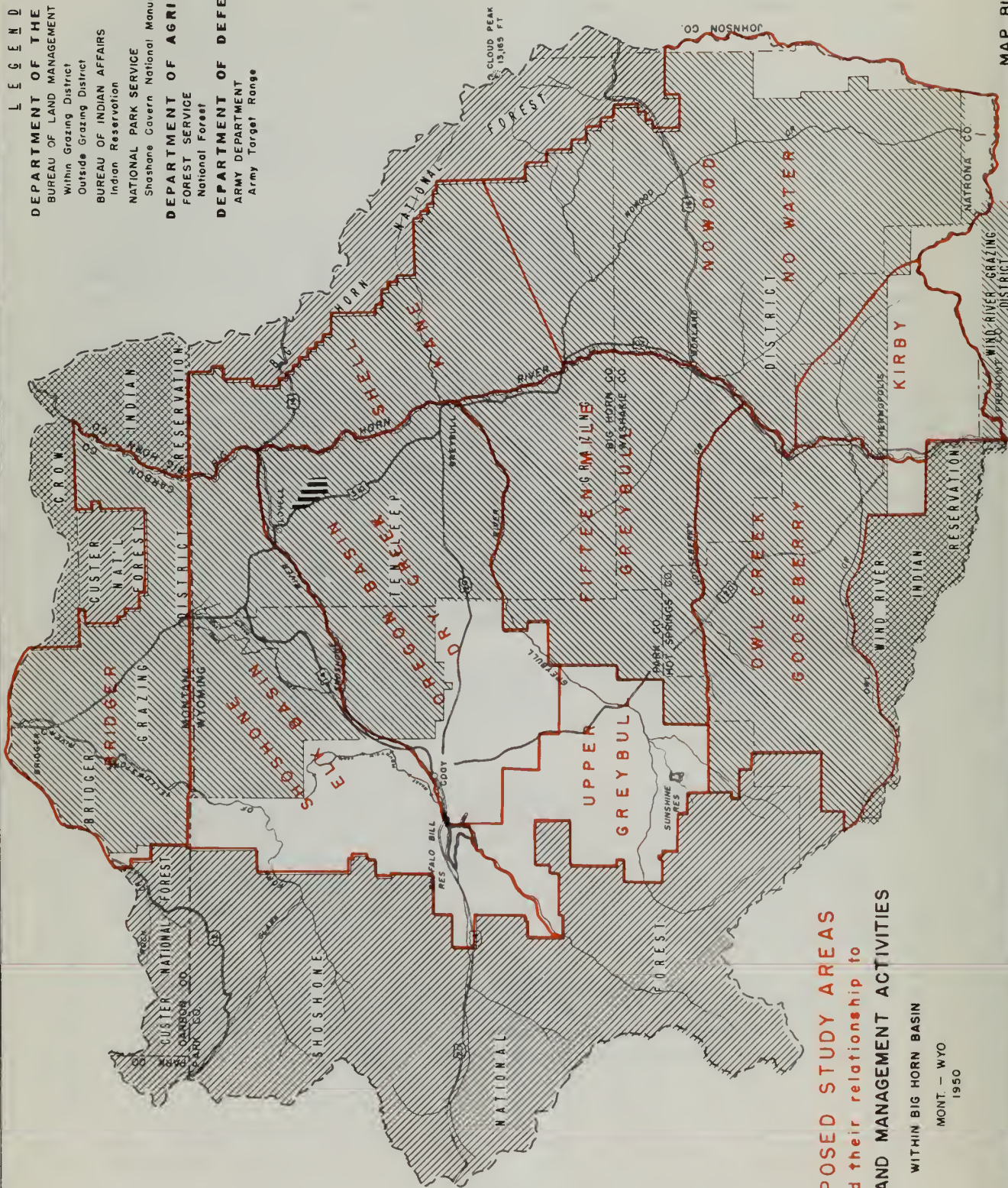
1. Nowood-NoWater Area, Wyoming, which will include the entire drainage area of NoWater Creek and Nowood River, exclusive of the Big Horn National Forest.

2. Kirby Creek Area, Wyoming, which will include the area tributary to the Big Horn River from the east and situated north of Copper Mountain and south and west of NoWater Creek divide.

3. Shell-Kane Area, Wyoming, which will embrace public domain in Wyoming Grazing District No. 1, located north of Nowood River-Shell Creek divide, east of the Big Horn River and south of the Wyoming-Montana state line, exclusive of the Big Horn National Forest. This area, plus areas No. 1 and No. 2, comprise all of the study areas located east of the Big Horn River.

4. Owl Creek-Gooseberry Creek Area, Wyoming, includes the area north of the Wind River Indian Reservation and south of Gooseberry Creek, west of the Big Horn River and east of the Shoshone National Forest boundary.

- LEGEND**
- DEPARTMENT OF THE INTERIOR**
- BUREAU OF LAND MANAGEMENT
 - Within Grazing District
 - Outside Grazing District
 - BUREAU OF INDIAN AFFAIRS
 - Indian Reservation
 - NATIONAL PARK SERVICE
 - Shoshone Govern National Monument
- DEPARTMENT OF AGRICULTURE**
- FOREST SERVICE
 - National Forest
- DEPARTMENT OF DEFENSE**
- ARMY DEPARTMENT
 - Army Target Range



PROPOSED STUDY AREAS
and their relationship to
MAJOR LAND MANAGEMENT ACTIVITIES

WITHIN BIG HORN BASIN
MONT. - WYO
1950

5. Fifteen Mile Creek-Greybull Area, Wyoming, includes area within the grazing district which lies west of the Big Horn River and between Gooseberry Creek and the Greybull River.

6. Upper Greybull Sub-Area, Wyoming. All of the lands within this sub-area are located in southern Park County (south and east of South Fork of Shoshone River) and between the Shoshone National Forest and the Tensleep Grazing District.

7. Oregon Basin-Dry Creek Sub-Area, Wyoming. Shoshone River forms the north boundary of this area, the Big Horn River the east boundary, the Greybull River the south boundary, and Area 6, described above, the north boundary. Public lands in this study area are relatively compact, with vast acreages of lands withdrawn for reclamation purposes found interspersed throughout the study areas.

8. Shoshone-Elk Basin Sub-Area, Wyoming, includes public domain lands located north of the Shoshone River and south of the Wyoming-Montana state line, west of the Big Horn River and east of the Shoshone National Forest. A portion of this study area is located in the watershed of Clark Fork of the Yellowstone. This study area surrounds the greater part of the Shoshone Irrigation Project of the Bureau of Reclamation. It contains large areas withdrawn for reclamation development.

9. Bridger Sub-Area, Montana, includes all public domain in the Montana portion of the report area.

The detailed studies to follow will consist of a classification program designed to answer the following primary questions, with respect to the public domain lands:

1. What are the extent and nature of the public land resources, including timber, forage, soil, water and other superficial resources?

2. What are the physical capabilities and use limitations of the public lands?

3. How, and to what extent, do public lands contribute to such problems as erosion, siltation, sedimentation, floods, pollution, fire and noxious weed and predatory damage?

4. How can the public lands and their resources best be used and managed for their greatest contribution to the general welfare of the basin and to the public in general?

5. How do these lands contribute to the needs for wildlife, recreation and similar public values?

6. What improvements, rehabilitation and protection measures are necessary to sustain the maximum usefulness of the public lands and their resources, and to what extent can such improvements, rehabilitation and protection be justified?

7. To what extent and where, will cadastral surveys and resurveys be needed to provide for the proper administration and development of the public lands.

Detailed studies will consist of a complete inventory of the public lands and their resources including an inventory of the forage and timber resources, land-use suitabilities and capabilities, the present condition of the land with respect to the soil type, erosion and watershed significance, present uses of the land together with needed or proposed adjustments in use in order that the lands may serve the purposes for which they appear to be best adapted. Improvements or development projects believed necessary in making land-use adjustments or in promoting the highest sustained use of the land under the comprehensive resource development program will be recommended for each local "problem" area.

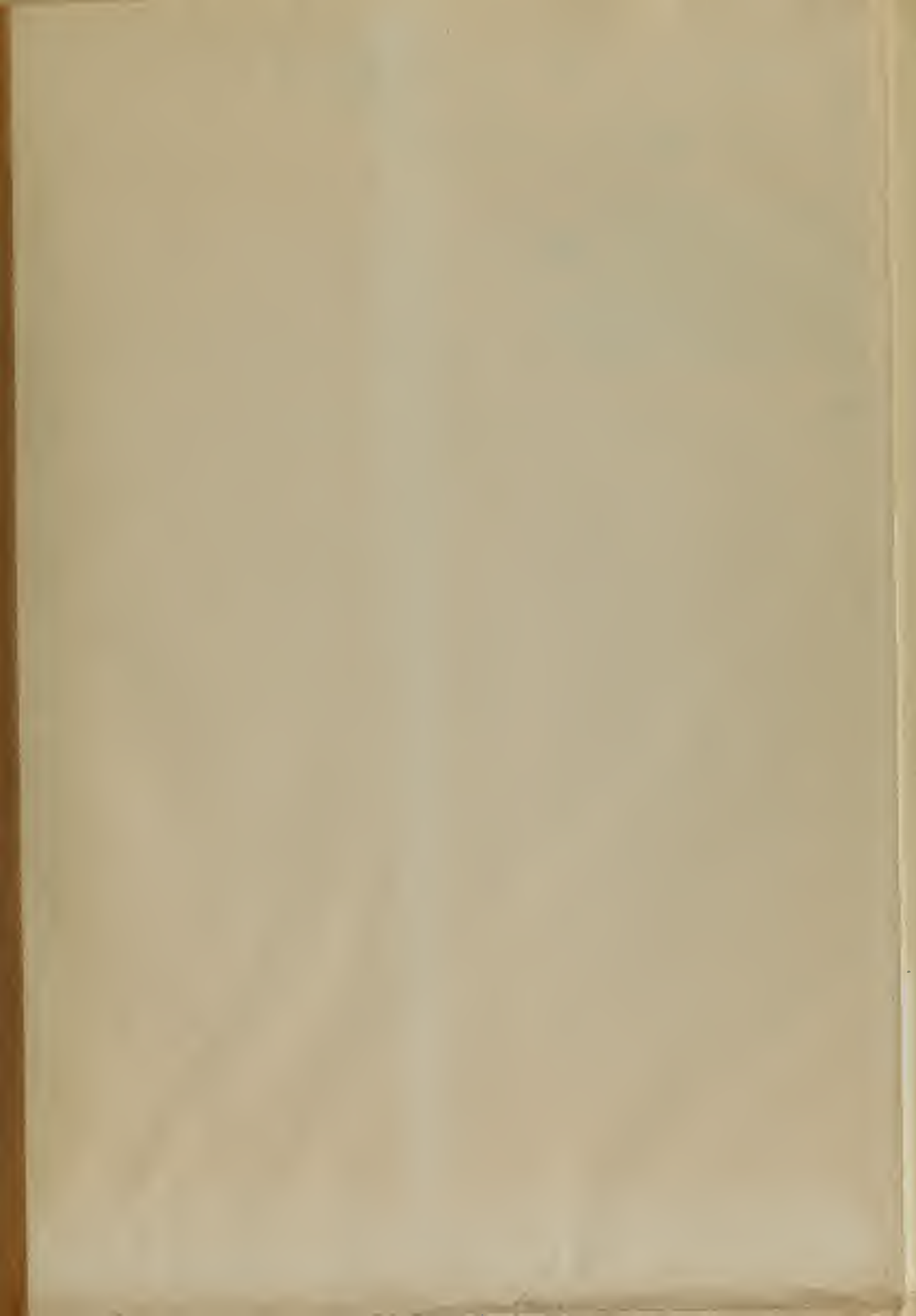
Report submitted November 28, 1950

A handwritten signature in cursive script, reading "R. D. Nielson".

Regional Chief,
Division of Land Planning



General view of Big Horn Basin near Greybull, Wyoming with Big Horn mountains in background.
Typical classification of land-use capabilities are shown in foreground.

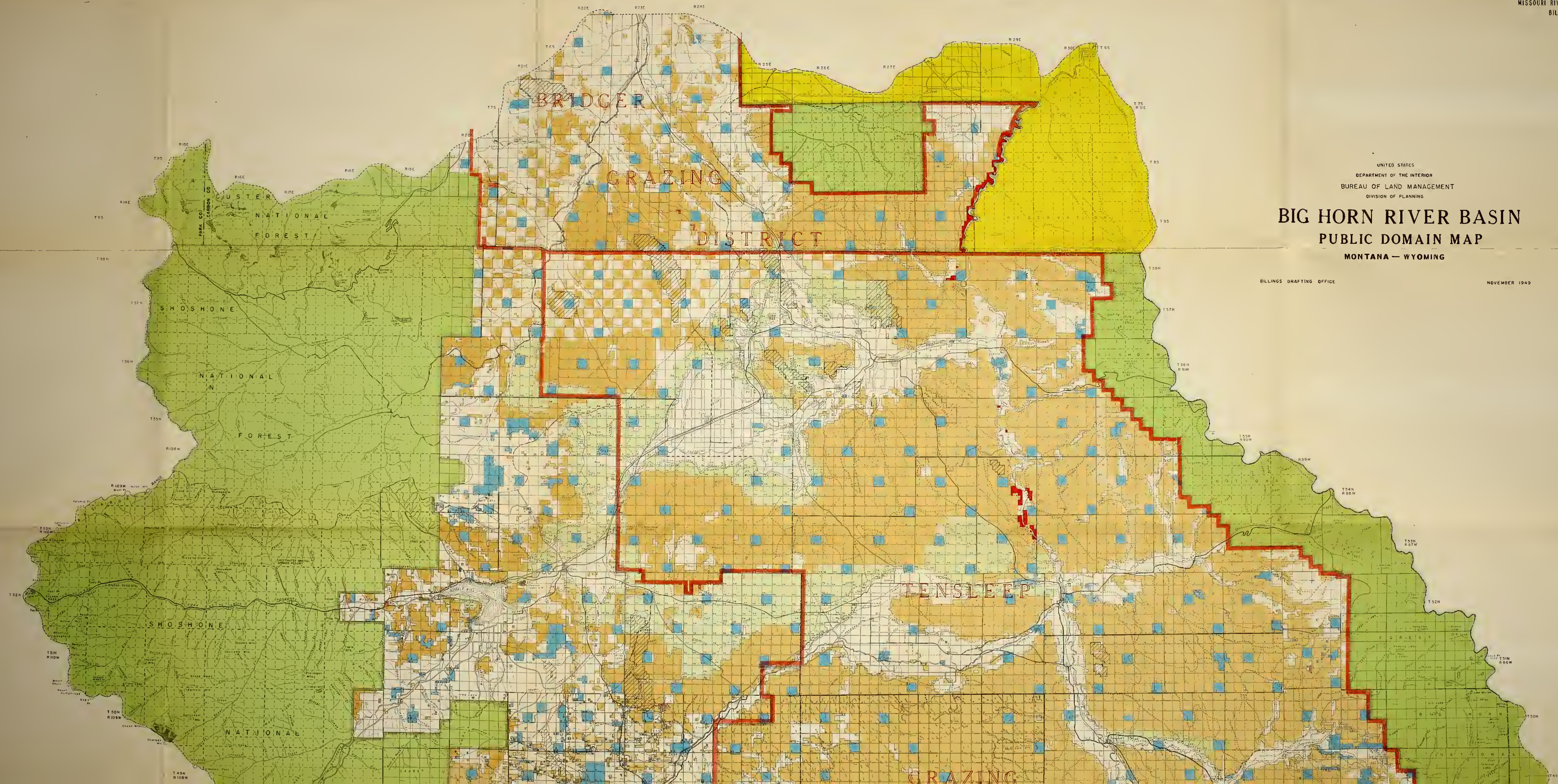


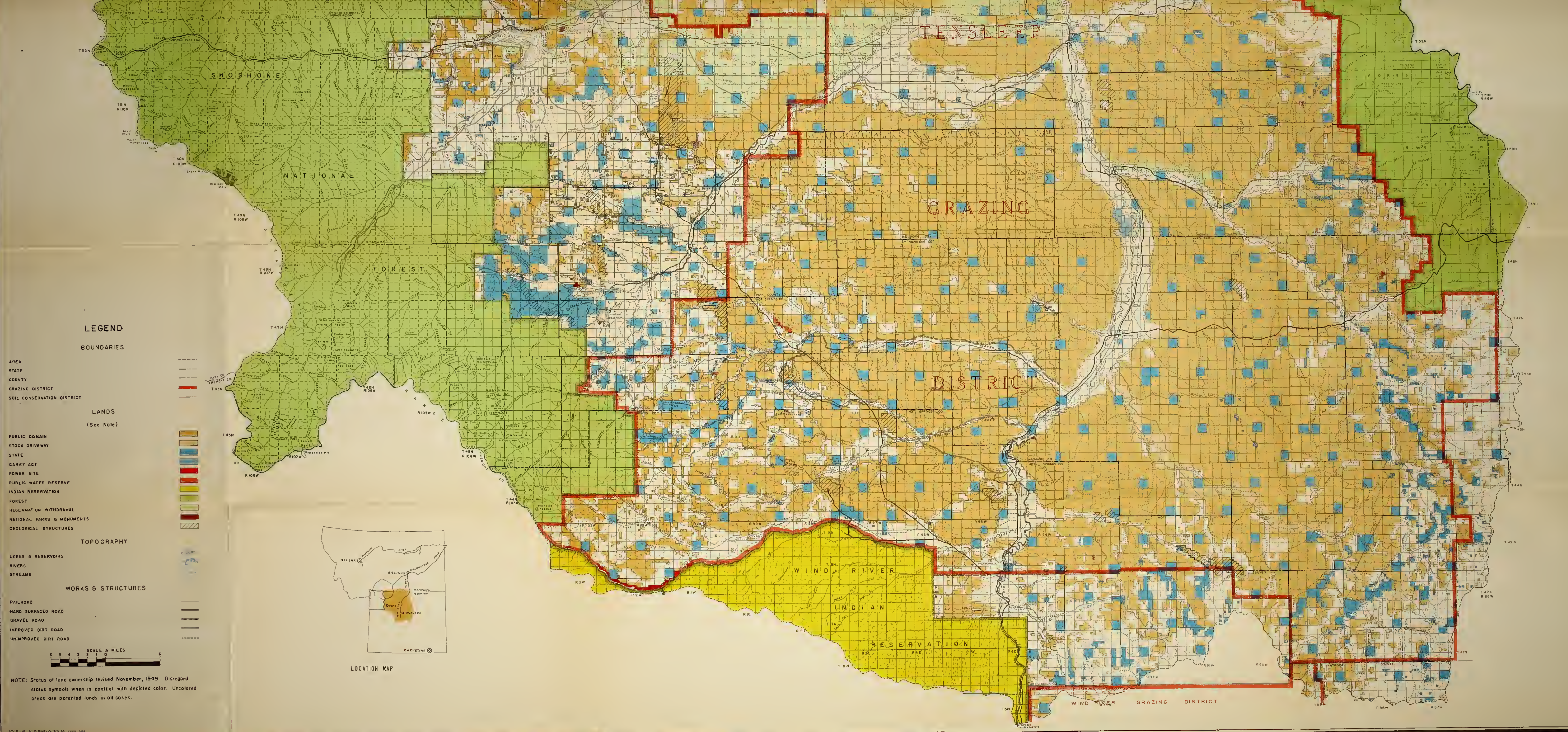
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

BIG HORN RIVER BASIN PUBLIC DOMAIN MAP MONTANA — WYOMING

BILLINGS DRAFTING OFFICE

NOVEMBER 1949





LEGEND

BOUNDARIES

- AREA
- STATE
- COUNTY
- GRAZING DISTRICT
- SOIL CONSERVATION DISTRICT

LANDS

(See Note)

- PUBLIC DOMAIN
- STOCK DRIVEWAY
- STATE
- GAREY ACT
- POWER SITE
- PUBLIC WATER RESERVE
- INDIAN RESERVATION
- FOREST
- RECLAMATION WITHDRAWAL
- NATIONAL PARKS & MONUMENTS
- GEOLOGICAL STRUCTURES

TOPOGRAPHY

- LAKES & RESERVOIRS
- RIVERS
- STREAMS

WORKS & STRUCTURES

- RAILROAD
- HARD SURFACED ROAD
- GRAVEL ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD



NOTE: Status of land ownership revised November, 1949. Disregard status symbols when in conflict with depicted color. Uncolored areas are potential lands in all cases.



LOCATION MAP



R'S CARD

45 1950b
of Land
Region III.
and planning
cation report

OFFICE		DATE RETURNED

(Continued on reverse)

HD 243 .W8 P745 1950b
U. S. Bureau of Land
Management. Region III.
Preliminary land planning
and classification report

